RAILROAD GAZETTE

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Contributions

Superheated Steam in Locomotive Service.

Hanover, Germany, April 22, 1902.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In my letter of March 11, which you were kind enough to publish in your issue of April 11, a slight error relating to competition between the different types of engines, somehow crept in. The 10 de Glehn locomotives, to which I then referred, will not be provided with superheaters. The competition will be between 10 of my engines, 10 de Glehn, and some others built on the Schmidt-Garbe system, and these latter will use superheated steam.

I have not, up to the present time, succeeded in designing a satisfactory superheater-compound engine. The best stationary steam engine practice certainly points to the great efficiency which would result in compound locomotive operation by the use of superheated steam.

A. VON BORRIES.

The Virtues of the Enclosed Automatic Disk Signal.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Now that you have got some of the main questions concerning the New York tunnel disaster out of the way, I want to ask you to consider for a moment one point which you briefly touched upon in your editorial of Jan. 17, that is of quite general interest, but which seems not to have received the attention which it deserves. You say that the most approved standard type of signal for daylight use is the semaphore; and the fair inference from your words is that the semaphore is the only signal which is recommended by "the highest signaling authorities."

Now, who are the highest signaling authorities? And when did they decide that the semaphore was the only proper signal? Assuming that the said authorities have so decided, what is the scientific and practical evidence on which that decision is supported? I ask these questions because the disk signal is still an important factor in the railroad world. Indeed, it is a very live signal. On the Boston & Maine, near Boston, automatic disk signals are in use which were erected over 30 years ago. Two other prominent New England railroads use hundreds of disk signals, including the outdoor disk, actuated by clock work. Enclosed disk signals are used on the eight-track line of the Illinois Central in Chicago, where they did remarkable service at the time of the World's Fair; they are in use on more than half of the main line of the Lehigh Valley; and they are the standard automatic signal of the Philadelphia & Reading and the Chicago & North Western. This is by no means a complete list; but it embraces many hundred signals. And perhaps the most significant thing about it is that the two roads last named are extending the use of enclosed disk signals.

This is a most extensive showing. One good reason why this signal continues to find favor is, of course, the low cost, as compared with other designs, both for installation and maintenance. But are there not good and important reasons besides that of low cost?

I think there are; and I wish to briefly set this forth. The main questions concerning an automatic block signal may be placed under the three heads of (1) reliability; (2) visibility; (3) cost. In the main, the reliability of a disk is the same as a semaphore; the same batteries, rail circuits and electro-magnets are used to control in one as in the other. Considering now the enclosed disk, it is protected from rain, snow and wind. The electric semaphore is exposed to all of these, and it may be so loaded with snow or ice as to stand in the all-clear position when there is a train in the block section. This is not an imaginary danger, as anyone may learn by inquiring of signal engineers who use this style of signal.

Railroad officers who have adopted the electric semaphore, worked by a motor, say that they have obviated this difficulty by arranging the signal to stand normally in the danger position. Passing over the point that this is not a complete safeguard, it must be observed that the arrangement for keeping automatic signals normally in the danger position involves an increased complication of wires, batteries and relays. Every one will agree that increased complication is a decided disadvantage, and that simplicity is or should be a cardinal feature in automatic signals.

The main objection to the disk signal is that snow may stick to the glass and hide the signal. Nobody denies this. The question is whether it will really cause serious inconvenience. I am now considering it under the head of reliability; but surely, if the enginemen follow the simplest rule of railroad operation, to stop their train when in doubt as to the meaning of a signal, there can be nothing worse than delay, so that it is a question not of reliability but of facility in operation of trains. With the usual force of trackmen, the snow can be wiped off from the faces of the signal cases as often as may be necessary. Certainly, there is less objection to entrusting this work to track laborers than there is to the employment of untrained men to knock the ice and snow off from semaphore blades. In the latter case, the man is in a position to interfere with a working part of the signal; with the enclosed disks, he cannot possibly interfere with the working parts.

Experience has shown that the trouble from snow is really insignificant. In the colder climates, this trouble may occur one day in a winter, or ten days; it is very irregular. An officer of the Chicago & North Western has said that the average number of snowy days on his road is not more than two days in each year; and this does not mean two whole days; it means that there were two days on which the glasses had to be wiped off.

Another objection is that light reflected from the sky as, for example, yellow light at sunset, will often make the surface of the glass appear yellow and thus interfere with the red indication of the signal. This objection is also readily admitted, but with equal confidence that nobody can show it to be a serious one. No fair-minded defender of the enclosed disk now claims that the color of the disk is of first importance. The essential nature of the indication is Light for all-clear, and Darkness for danger. In other words, a disk of gray, or yellow, or any other color affording a good contrast with the white (absence of color) which is used for the all-clear indication, would make a reliable signal. All the roads using the disk signals will tell you this.

This point is one that perhaps it is not necessary to elucidate, as it will be readily understood by anyone, whether versed in signaling or not. But in view of the objections which will be raised by those theorists who set great store on having stop signals uniformly red, and go-ahead signals uniformly of some one other color, it is worth while to here put on record this evidence, from the extensive experience now available, on many roads, that this alleged disturbance of the standard colors has not proved to be any real hindrance to the efficiency of the signals.

The claim that a disk signal is dangerous because the cloth of the disk will absorb moisture and thus put the signal out of balance, was formerly a matter of considerable moment, but this difficulty has been entirely removed. A signal which is normally adjusted will, if overweighted with moisture, remain in the stop position, and no harm is done. The trouble comes when a lazy inspector, to avoid the labor of strengthening a weak battery, changes the counterweight so as to overcome the abnormal weight of the cloth. This being done, the subsequent drying out of the moisture allows the signal to stand in the all-clear position, as the counterweight is on the all-clear side of the signal. The remedy is simply to so fix the counterweight that it cannot be increased beyond a safe limit. This done, the man must keep his batteries in good condition.

Visibility may be called a question of convenience. The questions of snow on the glass and of light reflected from the sky, are also mainly matters of convenience, as, with the most adverse conditions in this respect, trains can get along with nothing worse than some little delay. Visibility must be considered separately for night signals and for day signals. At night, when signals are most needed, the disk and the semaphore are all the same thing. Nobody disputes this, though the advocates of the semaphore seem to be very prone to forget to acknowledge it. In daylight, the semaphore has a great advantage in that it can be better seen—when? When you are a mile away from it. But why does anyone want to see a signal a mile away? You cannot see this distance unless the atmosphere is clear and the line is straight; but it is in weather which is not clear, and on lines which are not straight, that signals are needed. In short, the essential thing about a signal is to see it clearly when you are a few hundred feet away from it; and for this purpose the enclosed disk signals everywhere in use are admitted to be satisfactory. Enginemen have often made mistakes from seeing a signal too far away.

In this connection, I may add that the enclosed disks have an advantage over the semaphore in that they have in the black or white space around the disk, a uniform and distinct background. The semaphore often has a very unfavorable background; and the background of a given semaphore is often different at one season of the year from what it is at other seasons.

Our third head is cost. As already stated, the cost of the disk is much less than that of any other form of signal. As long as we depend on an electric current, from a battery, either primary or secondary, it is too obvious to be argued, that there will be economy of power in signals completely enclosed, as compared with outdoor signals. In the latter, we have to provide a large surplus of energy as an offset against a possible extra weight of snow to be moved.

If I have made myself clear, I have shown that the disk is equally reliable with the semaphore, and in some respects is more than equal; that the trouble from snow on the glass is not a serious matter, and that in design ing signals to be seen at a great distance we are wasting our energies. I have found no competent judge who pretends to deny these points, and therefore I claim that science and experience combine to sustain the superiority of the enclosed disk signal.

O. H. D.

The Air-Brake Convention.

The ninth annual convention of the Air-Brake Association was held in the Monongahela House, Pittsburgh, Pa., April 29, 30 and May 1. The attendance was the largest in the history of the Association, there being 176 present out of a total membership of 655. This was regarded as very gratifying, as it was feared that the restrictions on passes would interfere seriously with the attendance; however the situation of Pittsburgh is such that this did not affect the majority of the members. The large number present was probably due in some part to the opportunity to visit the works of the Westinghouse Air-Brake Co.

At its opening the convention was addressed by Mr. C. A. Robertson, representing the City Recorder of Pittsburgh. Mr. Otto Best, of the Nashville, Chattanooga & St. Louis, and the President of the Association, called it to order at 9 o'clock. Following are extracts from his address:

CURRENT CARE OF THE AIR-BRAKE.

The vast number of brakes applied within the past five years has resulted in a corresponding increase in brake repairs; the number of inspectors and repairmen being greatly augmented, and it has now become a recognized fact that the air-brake department of a railroad is one of great importance, second to none. Thousands of dollars are spent annually by railroad companies by reason of the improper supervision of the air-brake department in the purchase, application and repairs of brakes. A systematic organization can only be had by procuring the services of a first-class general air-brake inspector, who has full supervision over all matters pertaining to air-brakes, and is held responsible for the proper application, maintenance and operation of the brakes. The improper repairs which are constantly being made by inexperienced repairmen (I speak more particularly of triple valve repairs), demand the closest attention of the members of this Association. We should see to it that so far as it is in our power, none but competent men be put in charge of this work.

At the last meeting of this Association at Chicago a committee was appointed to represent it at the Master Car Builders' Convention, to urge the necessity of increasing the price for cleaning triple valves and brake cylinders to an extent that would induce railroad companies to take a more active interest in the cleaning of freight brakes, and thus promote their efficiency. The committee met with hearty co-operation on the part of the M. C. B. Association, and its mission was accomplished, in that the price for cleaning triple valves was increased from 10 to 20 cts., and that for cleaning brake-cylinders from 15 to 20 cts.

I am sorry to say that railroad companies have not manifested the interest they should in the repairs to freight brakes. The practice of cleaning and oiling brake cylinders through the oil plug with car, engine, or cylinder oil is still being carried on. It is not only in direct violation of the M. C. B. rules, but very detrimental to the cylinder packing.

While the proper cleaning of triple valves is essential, the repairs and testing after repairs have been made, is of much greater importance. The practice of cleaning triple valves without removing them from the auxiliary reservoir is still being indulged in by some railroad companies. A large majority are not testing them at all. The M. C. B. rules require that triple valves be removed, cleaned, oiled and tested, and too much stress cannot be put upon the word "tested." The railroad with which I am connected has at all terminal points a device for testing triple valves; first for packing ring leakage, second for release, third for tightness of slide valve, emergency and check valve, etc. The oiling of triple valves with car, engine or lard oil has been discontinued by the company I represent, and a light grease substituted. This practice has given remarkable results in the reduc-

tion of the number of cut slide valves and seats, distorted emergency-valve rubber seats, check-valve-case gaskets and triple-valve gaskets. The grease will not freeze in winter nor dry out in summer, and the working parts of the triple valve are sufficiently lubricated.

We find that two out of ten triple valves removed from freight cars are condemned on account of leakage by packing rings and failure to release. I am inclined to believe that some companies imagine that when they put brakes on their cars they should work forever without any attention or repairs, and enginemen and trainmen are often disciplined for the improper handling of the air-brakes, when, if the cause was justly placed, it would be attributed to inattention or improper repairs. One of the strongest features in air-brake practice and one which speaks more forcibly in a language of dollars and cents, is that of sl'd-flat wheels. An enormous amount is spent annually for replacing slid-flat wheels, and I do not hesitate to say that inattention and the improper test given triple valves can, in a vast majority of cases, be assigned as the true cause of slid-flat wheels.

General Air-Brake Inspectors are not meeting with hearty co-operation from some of the railroads, inasmuch as when air-brakes are repaired on foreign cars and bills rendered in seven cases out of ten they are returned with a voluminous criticism, every possible effort being made to have bills cancelled, attention being called to some rule which the writer thinks will sustain him in his opinion that the bill should be made void; all in face of the fact that parts were injured under fair usage.

The practice of partially overhauling air-pumps while on locomotives is being rapidly abandoned. It will be found much more economical and satisfactory to remove the air-pump from the locomotive, and have it taken to the air-brake repair room, substituting one which has been thoroughly overhauled and tested. In this way the pump can be entirely dismantled, put into a vat of lye heated to boiling point, after which the different parts can be thoroughly inspected and repaired. When the main valve bushing in the steam head of the 9½-in. air-pump is found to be considerably worn, this bushing can be forced out of the head, bored and re-bushed to the standard size for 85 cts. The left main-valve cylinder head can be similarly treated at a cost of 45 cts. This keeps the main-valve piston heads and packing rings to a standard size. New air-valve seats and cages should be applied when necessary. Steel air-valves should be used in place of brass. I have found that drilling a few small holes through the cylinder casting from a point immediately under the receiving valves to the atmosphere, will prevent valves from wearing the cages and seats oblong. Holes under top-receiving valves are bored through the cylinder casting; those for lower-receiving valve are bored through bottom of the cage.

Up to the present time special stress has been laid upon the importance of air-brake car instructions, and while we would by no means underestimate this form of instructions, we believe the time is now ripe for inspectors to get out on the road with the enginemen and trainmen, giving practical instructions as to the proper methods of handling air-brakes, and how to locate and correct troubles that manifest themselves en route. The precise nature of the instructions must of necessity vary to some extent on the different railroads. Those in the past have usually included a terminal test. This should always be done, but as an additional precaution a running test should be made with passenger trains. By running test is meant a sufficient reduction to enable enginemen to feel the retarding force of the brakes; this reduction to be made after the train has attained a speed of eight or ten miles an hour.

Within the past two or three years a number of railroads have adopted what is known as the two-application stop; that is, applying the brakes initially with a high braking force, releasing the brakes when the train has been brought down to a comparatively low rate of speed, then re-applying without re-charging the reservoirs. This practice has proven so very beneficial wherever it has been in vogue, in eliminating the skidding of wheels, that it is strongly recommended for the consideration of all air-brake inspectors.

The use of pressure retaining valves in connection with driver brake cylinders of freight engines is unquestionably a valuable adjunct, as this provides a means of holding the train bunched, and of preventing serious shocks, or break-in-two.

The Association voted its thanks to the Westinghouse Air-Brake Co. for a most liberal programme of entertainment provided for the members attending the convention. This programme included an organ recital at Carnegie Music Hall on Tuesday afternoon, a trip to Wilmerding to inspect the air-brake works Wednesday afternoon, attendance at the performance at the Alvin Theater Wednesday evening, a trip to the Carnegie works at Homestead Thursday afternoon, and the provision of musical and other talent for entertainment at a social gathering in the hotel Thursday evening. Also arrangements were made to take the ladies attending the convention to the Heinz pickle factory Thursday morning, and on a carriage drive around the city Thursday afternoon.

The next meeting is to be held at Colorado Springs, Colo., at a time to be decided on later by the Executive Committee. The officers elected are: President, J. E. Goodman, Northern Pacific; First Vice-President, W. P. Huntley, Chesapeake & Ohio; Second Vice-President, John Hume, Houston & Texas Central; Secretary, F. M. Nellis, Locomotive Engineering (re-elected); Treasurer, Otto Best, Nashville, Chattanooga & St. Louis; P. J. Langan, Delaware, Lackawanna & Western, was elected to fill a vacancy on the Executive Committee.

Extracts from papers and reports and the discussion thereon will be printed as may be convenient.

Roundhouse Air-Brake Work: Inspection and Repairs.*

This subject should be divided into three classes or parts—First: that part which pertains to the engineers and their knowledge of locating defects, and intelligently reporting them. Second: the inspector and the amount of inspection necessary. Third: the repair men and their facilities for doing the work.

At side tracks and terminals, engineers can and should do a good deal towards stopping leaks, locating defects and making out their reports of existing defects. . . . The report from an air-brake standpoint should include all defective air-brake and signal equipment, all the parasites known as bell ringers, sanders, blow-off cocks, etc., etc. A few suggestions as to how good reports should be made out and what they should include are:

Air pump runs too slow.
Air pump runs fast enough, but does not accumulate enough air.
Air pump heats excessively.
Air pump has uneven stroke. (Suggestive of broken or stuck air valve.)
Pump pounds badly.
Stuffing box packing leaks. (Specify steam or air end.)
Air pump stops frequently.
Defective air gage. (Comparing pointers of gage on release position.)
Governor will not shut the air pump off.
Governor will not allow air pump to start until air pressure is considerably reduced.
Governor leaks steam or air badly. (Specify where.)
Brake valve handles hard.
Rotary valve leaks. (To the atmosphere, or it causes release of brake on lap position.)
Defective feed valve attachment.
Defective excess pressure valve.
Preliminary exhaust port reduces the pressure from 70 to 50 lbs. in more or less than five seconds.
Equalizing piston fails to respond to light reduction. Train line exhaust seat leaking.
Triple valve leaks at exhaust port. (Tender or engine.)
Triple valve sticks.
Brake cylinder leakage. (Either packing leather, cylinder head joint or pipes.) To be located with a torch.
Piston travel. (Too long or too short.)
Air signal whistle blows when brake is released with brake valve.
Air whistle will not respond to proper reduction when coupled to train.
Air signal repeats when signal is given from train.

. . . Considering the intelligence of the engineers and their responsibility, the committee is prone to believe that many of them will shirk posting up, inspecting and reporting defects, when they know engine inspectors will follow them up and relieve them of that responsibility. Inspection of engines promiscuously or regularly by an inspector after the engineer leaves the engine, and afterwards taking up with him unreported work, is a means of improvement along this line. Where engineers are repeatedly found who do not take interest enough in their work to properly inspect and report common defects at the end of each trip, they should surely be made to feel it by their record or otherwise. The committee is justified in recommending this process simply because the air-brake is not a new device, it is being made more substantial each year, and enginemen are getting more accustomed to its derangements. If this method is not carried out to a considerable extent, air-brake instruction plants might as well be abandoned. It should also be remembered that one of the most discouraging practices brought before enginemen is the condemnation heaped upon them by many roundhouse foremen and repair men. Every engineer's report should be considered.

The question of the kind and number of air-brake failures brings out the class of inspection required to eliminate each class of failure. The examination of engine-failure reports, signed by the Superintendents of Motive Power and Machinery of two prominent railroads (the names of which are withheld by request) for a given number of months in 1901, show engine failures of air-brake equipment that caused three or more minutes delay, were as follows:

One road with over 500 engines had 284 failures; the other with over 1,000 engines had 182 failures of similar nature in the same length of time. The first-mentioned road claimed to have good regular air-brake inspection by a detailed inspector at the end of each trip, while the second had not nearly as much and depended on reports from engineers, the inspectors who did general inspecting of all parts of the engine, and the air-brake repair men. A remark was made by one of the master mechanics of the first-mentioned line, that he wished their engineers would take more interest than they did.

The advice of the committee would be that all roads should have a thorough air-brake instructor, whose duty should be to investigate the service, instruct engineers and others in the duties pertaining to their work, check up the engineers' reports and air-brake repairs made, keep in touch with the condition of the engine equipment by as much personal inspection as possible, scrutinize reports made out by inspectors; also have the assistance of each road foreman of engines. By this method of representing his company, he will be in a position to recommend just how much inspection and repairs each division of his road needs, with, of course, a minimum of expense. One of the reasons for having some kind of competent roundhouse engine inspection and first-class repairing is the pool system, which results from a rush of business or shortage of power.

*Extracts from the Committee report to the Air-Brake Association, April, 1902.

The committee recommends as follows: First—A quarterly inspection of the operating parts of air pumps, the detail of which should be carried out to the letter.

Second—The regular testing of air gages, as incorrect gages are at the bottom of many irregularities, such as too much pressure, resulting in flat wheels; too little pressure, causing stops to lengthen; or insufficient excess pressure, resulting in difficult release.

Third—Regular cleaning and oiling of brake cylinders and triple valves every six months, or oftener if necessary.

Fourth—The continued elimination of brake cylinder leakage, renewing of worn brake-shoes and adjustment of piston travel.

Fifth—Engineers should be held responsible for properly reporting defects at the end of each trip; also for regulation of train-line and reservoir pressure, eyen if they have the engine only one trip. Since gum or scale under the small valves of the different regulating devices is the principal cause of these irregularities, engineers should be instructed to reduce the pressure and clean the seats befor changing the tension of the adjusting springs. One road is reported as reducing the air-pump failures to a minimum by observing the quarterly inspection of pumps as outlined in the first suggestion.

Where practical, we would recommend that roundhouse work be done under the supervision of the same persons doing the air-brake work in back shops. The repairs are best made by keeping the same men working practically at the same line of work, and holding them responsible for repairs made. Where the work is coming in rapidly, it can be divided into two classes, viz.: One man to repair defects in air pumps, governors, brake valves, triple valves, air-signal, air-bellringers, and leaky or broken pipes; while the other man should take care of brake-cylinder leakage, brake-shoes, brake rigging, piston travel, and opening of all drain-cocks daily. Both men should work together on heavy work. These men are inspectors from their standpoint, and should be directed to use their spare time in bettering the condition of engine equipment. They are also inspectors from another standpoint, viz.: they ought to know whether the device is a fit subject for the back shop. They should certainly know their business, and be able, when defects exist, to quickly remedy the same. To this end the air-brake instructor can do considerable good.

When possible, it is best for repair men to test the defective apparatus, and locate the direct trouble, thus using their heads first, their hands and tools next. . . . There should be no general repairs made in the roundhouse. This can best be taken care of by changing defective apparatus and sending same to the back shop. The part removed from the engine should be tagged, describing the defects. Rebuilding of air cylinders of air pumps should be carried on extensively, as the air end will wear out twice as quickly as the steam end. Air cylinder work should include renewing of worn air valves and valve seats, also packing rings, if the cylinder is true. Experience has taught that rings fitted to worn cylinders do not give good results.

The facilities for making repairs include all such complete parts as air-brake apparatus, that are subject to defects, which will allow the necessary changes to be made, as well as a complete set of tools for carrying on the work rapidly. The hammer and set should not be tolerated, using them often destroys good apparatus. A suggestive list of tools the roundhouse air-brake repair men should possess, or have access to, is included in the following:

One air pump hoist; one device for lifting air pump; one top head lifter; one packing nut compressor; one discharge valve stop wrench, 8-in. pump; one air piston and head disconnector. (To use this device the Westinghouse Air Brake Co. has tapped the bottom heads to receive the ⅝-in. cylinder head bolt. The holes in the bottom head are placed 5½ in. on center. This device substitutes pounding on the piston while removing). One piston holder, while tightening nuts; one 8-in. valve case remover; one main valve and reversing piston remover; one air-valve lift gage; one tool for cutting off top of air valve for the proper lift; one pair of long small-sized tongs; one brake valve separating tool; one equalizing piston and valve seat reamer; one feed valve piston remover; one hose gasket and coupling cleaner; one air valve seat reamer for New York pump.

In addition to the above special tools, the repair man should have a tool box for carrying small tools. The small tools should include one hammer, one 12-in. monkey-wrench, small scrapers, several chisels, packing hooks, and the proper sized well fitting wrenches for different sizes of finished nuts; one 8-in. and one 18-in. trimo or Stilson pipe-wrench and one steel bar.

The drawings of the various tools enumerated, which accompanied the report, are not reproduced here. This report is signed by L. M. Carlton, Chairman; M. Marea; Geo. R. Parker.

Handling Air-Brake Work in Connection with Yard Testing Plant.*

In taking up this subject it will divide into two parts—First: The best Method on Repair Tracks. Second: The best Method in the Yard.

One of the first things to be considered is to have the plant properly installed by placing reservoirs at different intervals throughout the yard, which serve a two-fold purpose: of adding volume to the plant, and as a receptacle for condensation to prevent the pipes freezing up in the winter time, which would greatly hamper the work for which it was installed. Next to be considered are the men who are to operate the plant. These men should be thoroughly instructed on all the defects of the air-brake apparatus. . . . The men who do the cleaning of triples and cylinders should be thoroughly instructed in the importance of the proper condition of the cylinder packing leather, the fit of the expanding ring to prevent the ends from wearing through the leather or from having too much of an opening; also the amount and manner of applying air-brake grease, and the proper clamping of train pipes, retaining valve and release pipes. This will facilitate the handling of the work.

In all cases where a great amount of cleaning is done

*Extracts from the Committee report to the Air-Brake Association, April, 1902.

we would deem it advisable to take the triple valve off and replace it with a repaired one. It is essential at all terminal points that a good supply of all the different parts be carried in stock. By this we do not mean triple slide valves, graduating valves, pistons, piston packing rings or bushings, for any triple requiring repairs to these parts should be sent to a central point on the system where one or more men are stationed that are proficient in doing this class of work. It will be found to be of great advantage to install a triple-valve test rack in connection with each yard testing plant, as the quality of work derived from the use of such racks will increase the efficiency of the triple valve at least 50 per cent. . . . All triples should be taken off and brought to this rack to be tested. One man should be placed in charge of this testing rack and do all the testing and cleaning of triples. Those triples which do not stand the required test should be sent to the division point for the necessary repairs. . . . All repairs of retainers, release valves, angle cocks and cut-out cocks should be done in the shop, substituting repaired ones for those taken off.

When the triple has been changed and the cylinder cleaned, the hose from the test plant should be coupled to an engineer's brake valve, so mounted that it can be transferred to any part of the yard, and should, in all cases where convenient, be used in making tests. This should be coupled to the car, and the air turned in from the yard plant, the car charged up and an application of about five lbs. made to test the sensitiveness of the triple. At the same time note the efficiency of the packing leather, by allowing at least 30 seconds to elapse before making a further reduction.

Whenever it is convenient, a test gage should be applied to the exhaust of the triple to note the tightness of the packing leather and detect any other leaks in the brake cylinder. We deem this essential, from the fact that a new cylinder packing leather may be applied and not hold the pressure, and can only be detected by the use of the gage. We wish to lay particular stress upon this point, from the fact that one of the committee recently had occasion to investigate a runaway train on a mountain, and found one of the contributory causes was, that with a service application, 17 out of 25 brakes leaked off on account of defective cylinder packing leathers, which had the appearance of being sadly neglected as far as lubricant was concerned, and were otherwise in bad condition. . . .

Members of the Association find most of their trouble at terminals, with the transportation department, on the amount of time consumed in the inspection of brakes; but quality of work must be considered before quantity. And even both can be obtained if the general inspector is persistent in his demands for recognition on the repair tracks where the work should be done. The time can therefore be lessened on inspection when the cars are in service, and the friction reduced between the air-brake and transportation departments . . .

The rapidly increasing number of air-brake cars being hauled in our freight trains, and the higher ratio of the load to the light weight of the cars of recent construction, have developed conditions in the operation of air-brakes heretofore unseen; that is, the longer the air-brake train or the greater the number of air-brake cars used in any one train, the more important it becomes that each air-brake shall be in first-class condition. This more especially applies to the triple valve, which, in the event of the brake application, is dependent on the force of the rise in train line pressure for its release. The longer the train, the slower the rise and consequently the less will be the force; in many cases it will not be sufficient to have the desired effect on the veteran triple that has seen two or three years service without any care or attention. . . . The result is that the slow rising pressure will leak past the triple piston and charge up the auxiliary reservoir without releasing the brake. The results of stuck brakes on long freight trains are well known to all and need not be enumerated here. However, the importance of a periodical and proper inspection of the triple valves and cylinder packing leathers is very apparent and demands prompt action on the part of railroad companies in providing facilities and the proper organization for doing this work. The rejection or acceptance of a triple valve should not be left to the judgment of the inspector, for the reason that where this has been in practice in many cases, triple valves have been sent in for repairs that only needed cleaning, and triples that should have been repaired, were returned to service. This shows the importance and necessity for the triple valve test rack before mentioned. It also relieves the outside men from this part of the work, and the time previously consumed in cleaning triples can be devoted to the proper clamping of train pipes, retaining-valve and release-valve pipes, and tightening up the brake cylinders, which greatly lessens the work of the road inspector when the cars are in transit. . . .

In relation to the testing of trains in yards of division terminals in connection with the yard testing plant, the best method for doing this work is to have separate tracks where the desired time and attention can be given to these trains, as it is of the utmost importance that they be given special attention. When the road engine has been disconnected from the train, the inspector should connect the hose from the yard plant to the brake valve. Let it be understood here that the brake valve should be used in making these tests where convenient, or a frost cock with a $^5/_{16}$-in. hole be used in making the reduction from the train pipe, having a gage in connection with either one so that the tests will be the same as if given from the engine.

While charging the train from the yard plant, two inspectors, or not less than two, should be employed in testing trains when the number of cars in each train exceeds 25; one on either side of the train should proceed from the head to the rear end, examining all air-hose couplings and pipe joints, release valves and angle cocks for leaks, removing all defective hose, angle cocks where leak is caused by defective key, and release valves having leaky valve seats. After the necessary repairs have been made, the inspector should then apply the brakes by reducing the train-pipe pressure not less than 8 lbs. nor more than 10 lbs., and allow one minute to elapse before making any further reduction. By this can be determined defective brake cylinder packing, or leaks pertaining to the auxiliary reservoir, as any brake having such defects will not remain applied with this amount of reduction. By the old method of applying brakes, of opening the angle cock, these defects cannot be as easily ascertained, as the inspector may make an emergency application instead of a service, or may not make the required amount of reduction in applying, so that the brakes would not apply throughout the entire train. Therefore, the necessity of the brake valve or the frost cock.

When the brakes are applied the inspectors should then proceed to go over the train, adjusting piston travel and renewing all defective packing leathers. If there should be too many packing leathers defective, which would require too long a time to repair, or would in any manner detain the train, these cars should be properly carded and switched out so that the necessary repairs can be made.

When we take into consideration that our fast freight trains of to-day, run at an average rate of speed of from 35 to 45 miles an hour, it can easily be seen that to run them with any degree of safety, we must sacrifice time for the proper inspection, and any delay caused at a yard terminal, due to inspection of brakes should be considered while the train is in transit. As previously stated, this time consumed in the yard can be greatly lessened if the proper attention, both in design and maintenance is carefully watched on the repair tracks. . . .

At all terminals, supply boxes or sheds should be placed at both ends of the yard, or in the most convenient places for the inspectors to reach them so as to lessen the work of the inspectors in going for repair parts while inspecting a train.

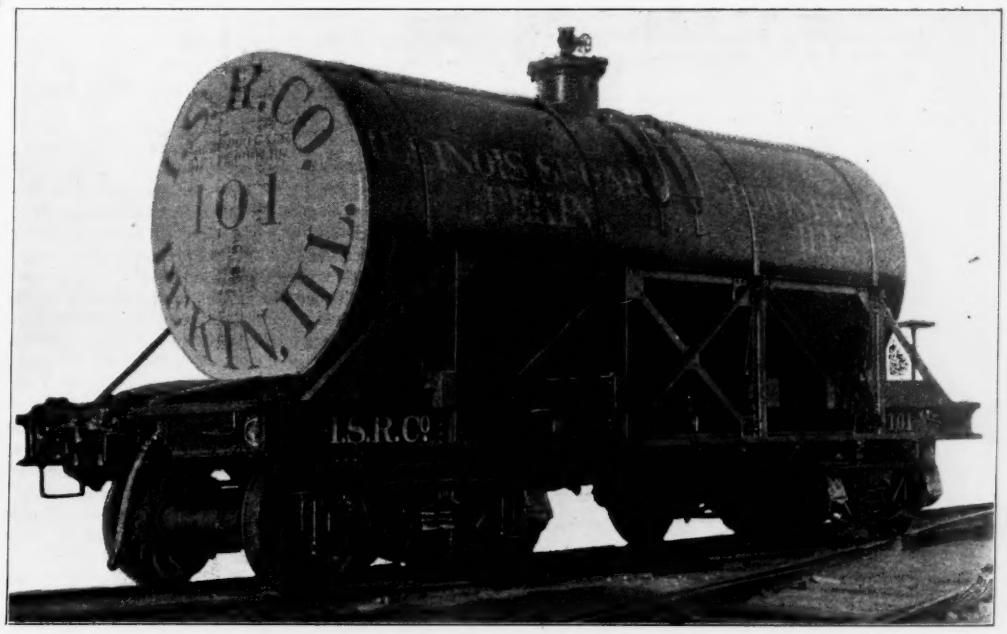
This report is signed by: P. J. Langan, Chairman; C. C. Farmer, F. J. Berry, W. P. Garrabrandt and F. Von Bergen.

Tank Cars With Steel Underframes.

The American Steel Foundry Co., St. Louis, Mo., has recently built 30 tank cars with steel underframes for the Illinois Sugar Refining Co., which will be used for hauling glucose. The design of this car, which is novel, is shown by the accompanying engraving. The tank has a capacity of 6,000 gallons and the barrel is made of a single ¼-in. steel plate. The loading capacity of the car is 72,000 lbs. and the light weight is 31,500 lbs. The dome is much smaller than could be used if the cars were intended for oil.

The length over end sills is 27 ft. 9 in., the greatest width is 9 ft. 6 in. and the tank is 21 ft. 10 in. long by 6 ft. 10 in. in diameter. The bottom of the tank is 4 ft. 4 in. above the rail and the height of the car over all is 12 ft. 7 in. The underframe consists of two channels for center sills which support the tank and transmit a portion of the load direct to the body bolsters. The remainder of the load is transmitted through the needle beams, from the center sills to the trussed side sills. The needle beams extend across the car beneath the center sills and at the other ends are built into the side trusses. The side sills are simple riveted trusses made of angles, and the end sills, body and truck bolsters are of steel castings. Level with the bottom chords of the side trusses are running boards carried on brackets and extensions of the needle beams.

These cars are equipped with American trucks, having arch bars and cast steel bolsters. The journals are 5 x 9 in. and Miner draft rigging is used.



Tank Car with Steel Underframe.
Built by the AMERICAN STEEL FOUNDRY CO., *St. Louis, Mo.*

Frozen Train Pipes, Their Cause and Prevention.*

. . . There are two ways in which water may get into the train pipe. First, by entering dangling hose in the form of water, snow or steam. Second, by its entering in form of vapor or water with the compressed air. The prevention of the first should need no explanation. . . . The prevention of the second cause is not so easy; and in order to arrive at some definite and reliable conclusion the committee made some extensive tests at the shops of the Boston & Albany at Springfield, Mass., and the New York, New Haven & Hartford shops at Norwood, Mass. Tabulated statements of the committee's tests will be found hereinafter in this paper.

In the early progress of the work the committee was led to believe that no matter how much moisture the compressed air contained, if the air were permitted to cool to the temperature of the surrounding atmosphere at the main reservoir before passing through the engineers' valve, there would be no material, if any, deposit of moisture in the train pipe. For example, a jet of steam may be directed into the air strainer of the pump, so that a larger amount of water than the atmosphere can hold in suspension at any ordinary temperature, may be taken in with the air; yet no water will be deposited in the train pipe, if the air is permitted to properly cool in the main reservoir before passing back into the train pipe. . . . The principal object of the tests at the Norwood shops was to prove that in actual operation, no water would be precipitated in the train pipe when the air is cooled in the main reservoirs, to a temperature that is no higher than that of the surrounding atmosphere when it leaves the last reservoir, no matter how much water or moisture may be taken in by the pump; also, that under the same relative conditions, when the air leaves the last reservoir at a higher temperature than that of the surrounding atmosphere, moisture will be precipitated in the train pipe. This was proved to the entire satisfaction of the committee. . . .

The question: "How can the compressed air supplied by the pump be cooled to the temperature of the atmosphere?" was found to be hard to answer, and the problem presented, difficult of solution. It was decided: First, that air taken in by the pump should be of no higher temperature than that of the atmosphere. Second, that the air cylinder of the pump should be in good condition, and that the pump should be run at as moderate a speed as possible. Third, that several lengths of piping for cooling the air be located between the pump and the first reservoir; also between the first and second reservoirs where more than one is used. Fourth, that reservoirs be located so as to be affected as little as possible by the radiation of heat from the boiler. It was shown in the tests at Norwood, that the air having been heated by the pump to over 425 degrees was cooled to the temperature of the atmosphere by passing through the seven lengths of 18-ft. pipe 1¼ ins. in diameter. Just how many lengths of pipe were necessary to accomplish this specific result was not ascertained; but the value of the piping for this

*Extracts from the Committee report to the Air-Brake Association, April, 1902.

purpose was very apparent, and the committee would earnestly recommend the use of sufficient piping to cool the air, and ample main-reservoir capacity to obtain the necessary volume of air for practical train operation.

It is believed and asserted by the committee that the main-reservoir capacity on freight engines cannot be too large, and that the greater it is, the slower the pump may be run; and consequently, the slower the air will pass through the piping and reservoirs, permitting more time for cooling. . . .

In tests where the engineers' valve located in cab was used, the temperature of the air in the train line at rear of tender was several degrees higher than at the exit of last main reservoir. This was found to be due to the train pipe, as it left the engineers' valve, running for some distance in contact with the bare boiler head, causing the air as it passed through the pipe to become heated. . . .

Summary.

It was very noticeable in the tests that the speed of the pump affected the temperature of the air delivered, apparently much more than the increase of pressure, for a high temperature was obtained when the pump was run at a high speed with a low pressure, and that with a high pressure the temperature dropped very quickly when the speed was reduced. It is not desired from this, to have it understood that the committee wishes to convey the idea that for the same speed the pump will deliver cooler air at a high pressure than at a low pressure, but that it appeared in the tests that the speed of the pump affected the temperature more than the pressure.

While the committee can give assurance that no precipitation will take place in the train pipe when the air is cooled in the main reservoir to a temperature of the surrounding atmosphere, it would, nevertheless, recommend that the train pipe on the tender be blown out before attaching to a train; also that in freezing weather a running trial of the brakes be required at a sufficient distance from railroad crossings at grade and other important points where it may be necessary to stop, so that the train can be stopped by the hand brakes, if found necessary. The committee would further recommend that the condensation be drained from the main reservoir and tender drain cup after each trip.

In summing up, the committee finds that the requirements necessary to prevent frozen train pipe are: to couple properly all hose not in use to a properly constructed dummy coupling; to permit no air to leave the last main reservoir at a higher temperature than that of the atmosphere; and to prevent any amount of water from accumulating in the main reservoir by draining after each trip. . . .

The table of results from the various tests, which accompanied the report, are not reproduced here. This report is signed by: F. C. Whitney, Chairman; E. C. Desoe, A. B. Brown and J. E. Goodman.

Street Car Fenders and Brakes.

A valuable report has been made to the Board of Public Improvement of the city of St. Louis by a committee consisting of Messrs. E. A. Hermann and Hiram Phillips, on the subject of street car fenders and wheel guards. The fact was brought out, by a series of tests, made with 15 designs of fender, upon dummies resembling men and boys in size and weight, that none of the fenders scooped up the dummy in every test, and that all the fenders failed oftener, (most of them much oftener), than they succeeded in scooping up the dummies. The treatment of the dummy was in every case more or less severe. With either the protruding or the non-protruding type of fender, death or crippling due to the force of the blow is likely to result in the case of human beings, if struck at a greater speed than eight miles per hour. The treatment of a victim by a non-protruding fender, if it properly catches up the endangered person, is perhaps more severe than that of the other type, because the process of saving involves first knocking down in order to pick up.

The committee strongly recommends equipping every electric street car with wheel guards, which will cushion a blow when struck. The committee believes that relatively inefficient as fenders in general appear to be, judged by the results of these experiments, they nevertheless do more good than harm and should be used. The gist of the report lies in the fact that the committee virtually point out that the best way to save the life of a person on the track in front of an oncoming car, is not to try to scoop him up, but not to strike him at all, and that this desirable condition in street railroad operation may be approximated by the equipping all such cars with efficient power brakes.

A Water-Tube Locomotive Boiler.*

BY SAMUEL STEWART RIEGEL.

In the words of Professor Goss, "It is the steam generator which affects mostly the power of the locomotive," and "the maintenance of pressure in the cylinders demands steam from the boiler, and hence the limit of cylinder work is reached when the boiler can no longer meet the demand which is made upon it." Attempts have been made repeatedly to overcome this difficulty. On every hand there are attempts to get better steam generators and to effect economies in coal consumption. Most attempts have been to secure larger heating surfaces and larger grate areas, or, in general, boilers larger in dimensions; but as far as the writer is aware, few attempts have been made to secure a marked increase in water circulation; and yet, upon this largely depends the higher efficiencies of steam generators. Upon rapid circulation of water over the hottest surfaces, the evaporative efficiency of a steam generator depends and likewise the economy in coal consumption and the power of the boiler. With the importance of circulation in view and having in mind the many noteworthy attempts of others to provide greater heating surfaces, the accompanying descriptive matter and designs are submitted.

In the designs here illustrated the idea is to hold fast to that which is good in other developments and to add a circulating device, which is shown in sufficient detail. All previous attempts to obtain 6,000 sq. ft. of heating surface in a locomotive boiler have entailed a proportionate increase in the boiler dimensions, and the 6,000 sq. ft. limit was not reached. The Atchison, Topeka & Santa Fe, decapod, illustrated and described in the *Railroad Gazette* of Jan. 31, 1902, approaches this limit more closely than any other thus far used, the total heating surface being 4,682 sq. ft. Using that boiler as a basis, it is here attempted to show how it may have its heating surface extended to 6,000 sq. ft., or even to 6,538 sq. ft., without altering the outer dimensions, except in a small increase in width over the mud-ring. In addition to this great increase in heating surface we should have a very rapid circulation of water over 1,885 sq. ft. of heating surface in the fire-box, the evaporative efficiency of which would be far above any ordinary locomotive boiler of its size and weight.

This, then, is an application of the idea to a 77 in. boiler and with an 84 in. boiler over 7,000 sq. ft. of heating surface would be available. This would seem to set at rest the question of how to reach 6,000 sq. ft., or 7,000 sq. ft. of heating surface and also to provide a boiler with evaporative efficiency to meet the needs of the cylinders.

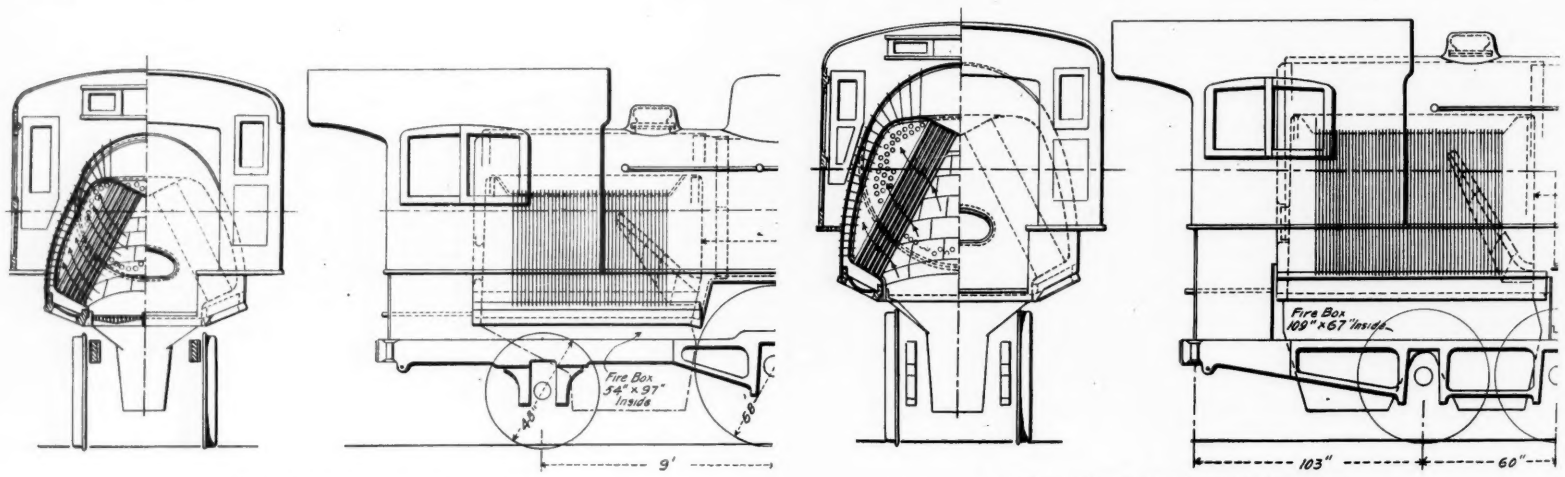
The illustrations show applications to both passenger and freight service. The design is based on inserting nests of water tube generators in the fire-box, along the sides as shown, thus making a simple, inexpensive, and highly efficient boiler, the vital parts of which are easily accessible for inspection and repair. By putting a brick arch forward in the fire-box the gases are made to impinge upon and between the water tubes and against the fire-box side sheets. The travel to the flues and thence to the stack is as usual.

It should be noted that the mud-ring is of cast-steel and is made double along the sides with upward extensions to which the boiler side sheets are riveted. There is sufficient space between the double portions of the ring to allow the insertion of the water-tube generators, and the two parts of the mud-ring are joined as shown. The fire-box side sheets are turned inwardly at the bottom, and the crown sheet is depressed to accommodate tubes of uniform lengths.

For comparison of boilers the following table is given. It will be observed that the total heating surface with two sizes of generator tubes, 1¼ in. and 1¾ in. respectively, has been calculated in the large boiler to show the range of possibility in the heating surface. In the smaller boiler only one size, 1¾ in. generator tubes, have been calculated. By this type of boiler the heating surface has been increased in the decapod, from 4,682 sq. ft. to 6,538 sq. ft., and in the Atlantic type boiler from 2,066 sq. ft. to 3,371 sq. ft.

Comparison of A., T. & S. F. and Riegel Boilers.

	A., T. & S. F.	Riegel Patent.	
	Decapod.	Decapod.	Atlantic.
Gage	4′ 8½″	4′ 8½″	4′ 8½″
Fuel	Oil and soft coal.	Oil and Coal.	Oil and coal.
Weight in working order	259,800	259,800	145,000
Weight on drivers	232,000	232,000	85,000
Wheel base, driving.	20 ft.	20 ft.	6′ 4″
Wheel base, rigid	20 ft.	20 ft.	6′ 4″
Wheel base, total	28′ 11″	28′ 11″	25′ 6″
Cylinders	17½″ and 30 x 34″	23 x 34″	18 x 26″
Diam. of drivers	57″	57″	68″
Boiler, style	Extended Wagon Top, wide fire-box.	Semi-Water Tube, wide fire-box.	
Boiler, dia. 1st cyl. course	77″	77″	58″
Boiler, working pressure	225 lbs.	225 lbs.	200 lbs.
Boiler, fire-box	108 1/16 x 79¼″	109 x 67″	97 x 54″
Boiler flues, No. of	413	427	295
Boiler flues, diam.	2¼″ O. D.	2¼″ O. D.	2″ O. D.
Boiler flues, length	18′ 6″	18′ 6″	13′ 10″
Boiler water tubes, number of 1¼″	.....	838	.....
Or, Boiler water tubes, number of 1¾″	.....	518	498
Boiler water tubes, diam.	.....	1¼″ or 1¾″	1¾″
Boiler water tubes, length of	.....	6 ft.	4′ 7″
Heating surf., flues	4,476.5	4,652.8	2,137
Heating surf., fire-box	205.41	238.3	189
Heating surface of 1¼″ generators	.....	1,646.67	.....
Heating surface of 1¾″ generators	.....	1,423.5	1,045.4
Fire-box heating surface, total with 1¼″ generators	.....	1,885	.....
Fire-box heating surface, total with 1¾″ generators	.....	1,662	1,234.4
Heating surface, total 1¼″ generators	.....	6,537.7	.....
Heating surface, total 1¾″ generators	.....	6,314.6	3,371.4
Heating surf., total.	4,682	6,537.7	3,371.4
Grate surface	59.47 sq. ft.	49.5 sq. ft.	35.3 sq. ft.



Design Adapted to Atlantic Type. *Design Adapted to Consolidation Type.*

The Riegel Water-Tube Locomotive Boiler.

*These boiler designs were recently patented by the writer of the article. Mr. Riegel is with the Brooks Works of the American Locomotive Co., but speaks only for himself and his design.

The Use of Ton-Mile Statistics.

BY J. SHIRLEY EATON.

The inauguration of ton-mile statistics on a great English railroad raises anew the question "What practical use is the ton-mile for statistical purposes?" Up to this time English practice has adhered to tons carried (sometimes called tons lifted) as the statistical unit. Americans have used the ton-mile, which is the tons carried, combined with the factor of distance carried.

Ton-mile statistics are necessary if we would know what a railroad is doing. Now in one shape and now in another, there is always present to the railroad manager one great fundamental question, "Was the dividend earned?" Mere statement of surplus from operation for any single period conveys little information as to the vital condition of a property and the standard of its operation. We must know whether it is losing or gaining ground. Is the cost of its product increasing or decreasing? Is it selling its product in a rising or falling market. In a conservative management the dividend policy is controlled by these vital considerations. If the average receipt per ton-mile is declining in a greater

ratio than the average expense, dividends must be deferred and even the capitalization itself may need adjustment. Without the ton-mile we are not able to know whether the shrinkage of net earnings is due to poor operation or to falling rates.

To look after the condition of operations we should know how far the volume of business is up to the capacity of the plant. This can only be accurately shown by the ton-miles per mile of line, single and double track. Then we should know how well balanced this traffic may be. These are purely commercial considerations, but they lead the way, in more careful analysis, to the inquiry as to how far rates have been adjusted to stimulate traffic at the weak points and thus bring the business up to the capacity of the road.

What have the operating department been doing with their 10 talents? What has been the average speed in miles per hour of their freight trains? How many miles have they got out of their cars and locomotives? Then, how many tons have they hauled in their trains and how much of their trainload has been tare through poor car distribution or poor car loading?

These are simple but supremely important questions. For answer we must have not only car miles and locomotive miles, but ton-miles as well. It is not alone necessary to have these figures at the time of the annual exhibit. They must be had currently—every month. It would be better still if they could be had every 10 days. Statistics like any other information have no usefulness except at points of option where choices must be made. They are past experience to guide us in the present situation. Hence their conclusions must be instantly available for the present emergency. Further than this, while they are finally registered in grand totals for a period, they should be parcelled out in small groupings so that they can be identified against individual responsibilities, because statistics must be essentially disciplinary if they are to be of any practical value.

Much that has been claimed for the ton-mile is claimed also for the "tons hauled." In reply it may be said that there might be conditions when the factor of distance is superfluous. Thus, if the distance hauled is insignificant, or if the haul is a trifling incident of the entire service performed, or if the distance is always the same or nearly the same, there would be no important reason for considering distance. But except on mere yard switching, where distance is an inconsiderable factor, such conditions are never heard of. It would be only in very rare cases throughout a great railroad's traffic where the distance hauled would be a constant. Our comparisons are one road with itself at some previous period and then with other roads and other divisions. Distance in all these comparisons, with varying lengths of haul and varying extents of line mileage is nowhere a constant or an insignificant thing and therefore cannot be safely eliminated.

Nobody claims for the ton-mile that it is an ultimate unit, but only a more nearly perfect unit than the "ton lifted." In fact, it is itself set about with serious limitations, both as a unit of expense and of service, which call for great care in using it. A ton-mile on a short road is a different thing from a ton-mile on a long road. Again a ton-mile of coal is a different thing from a ton-mile of baskets, both on the side of cost and on the side of the value of the service performed.

To sum it up, ton-miles are necessary to know what use superintendents are getting out of their power and out of their cars, what use the road as a whole is getting out of its plant, how far it is balancing its traffic, whether the fault of decline in net earnings lies with the traffic department or the operating department, and finally whether the service or commodity which the railroad is offering in the public market is declining in value more rapidly than the cost of producing it. These are the conditions on which the entire value of the property must ultimately rest, regardless of what may be its book capitalization.

The Conditions Governing the Panama and the Nicaragua Canal Routes.

[An address by Mr. George S. Morison before the Massachusetts Reform Club, Boston, April 24, 1902.]

In introducing Mr. Morison, the president of the Club alluded to the judicial attitude of the Club, due to its lack of information.

Mr. President and Gentlemen of the Reform Club: I had supposed that the Isthmian Canal question was one of such importance and such interest that all members of this club knew something about it. After the confession of your president, I can say but one thing: I hope his ignorance is not characteristic of the other members of the club. If it is characteristic of them, which I am not willing to believe, I must simply say that I am the wrong man to-night; for I have not come to speak of the relative merits of the different canals. I have thought that was a subject which had been described and talked of until it was understood. Two months ago, in another city where I was asked to speak on the matter of the Isthmian canals, I did describe their relative merits and gave my own views as succinctly as I could. I do not wish to repeat to-night what I said then; but if your president will promise to give up his prejudiced ignorance and to read what I said that night, I shall be happy to give him a copy of it and let him lend it to any other member of the club who may prove to be as ignorant as he is himself.

I have considered that the question of physical superiority had been thoroughly and permanently settled in favor of Panama. I remember saying to some of my friends more than 20 years ago, when I knew little about the subject and when the matter of the Isthmian Canal was first brought prominently before the American public as an actual work to be done, that I believed the true solution was a tide-water canal at Panama; but that I believed it was so expensive and so difficult a thing that its construction should be deferred till the twenty-first century, and that the Nicaragua Canal would make a cheap tool to be used meanwhile. I confess that even then my views were wrong. But the changes which have taken place on the ocean, in the merchant marine, have been so rapid in those 20 years that even assuming that Nicaragua would have made an economical and efficient tool 20 years ago, it would not do so to-day.

A general comparison of the two canals may be very simply made. The first great advantage of the Panama Canal is that it is so short a line between the two oceans. This means that a ship can enter it in the morning and be in the other ocean at night. To go through the Nicaragua Canal would require three times as long as to go through the Panama Canal. That means one of two things: It means either running three days, thus losing two more than at Panama; or it means running by night. That small ships would go through the canal and river by night, I have no doubt. But that large ships would do it in a country of Nicaragua's climate, where there is one of the heaviest rainfalls in the world, I do not believe. This is, in the first place, the prime great advantage of the Panama Canal, the short time which a ship will have to stay land-locked. A ship belongs at sea; it does not belong 25 miles inland.

The next advantage, which comes from the same short length of the canal, is the fact that the Panama Canal, crossing the narrowest portion of the isthmus, will occupy the position of a strait; it will not interfere in any way with the countries on either side. It simply is the occupation of a line of transit, which can be kept entirely clear of international complications. The Suez Canal has become the recognized boundary between Asia and Africa. There is no reason why the Panama Canal should not become the recognized boundary between North and South America. This cannot be done with the Nicaragua Canal. The Nicaragua Canal must go for practically 200 miles through a country which is capable of settlement and development. This long stretch of country cannot be occupied without more influence on the adjoining countries than it is desirable to have. One is an independent location. The other is a location complicated with surrounding political conditions.

These two reasons alone seem to me absolutely conclusive as to the superiority of the Panama Canal when it is done. There is one other thing upon which I ought to say a word, principally because of the ignorance which your president has expressed and has tried to ascribe to the whole Reform Club. The best possible solution would be the tide-water canal, when it was done. Of that, I have not the slightest doubt. But the difficulty in building a tide-water canal is principally one of time. It would probably take at least 20 years to construct a tide-water canal at Panama. It might take 25 or 30. This is a very serious thing; and the advantages which the tide-water canal would have over a canal with a moderately high summit level, approached by locks, are not commensurate with this additional loss of time.

So much for the canal when it is done. There is another thing to which I attach considerable weight. I fully believe that the Panama Canal, including all that may be paid for concessions of French rights or anything of that kind, will cost a great deal less than the Nicaragua Canal; that the difference will be very much greater than has been estimated even in the report of the Isthmian Commission. There are several reasons for this. The Commission, in its effort to put everything on as even a basis as possible, has perhaps overstepped the mark. The same prices have been used throughout for both canals. The same percentage has been added for contingencies, although at Panama a very large portion of those contingencies have already been met and provided for in the work which has been done, and although the opportunities for investigation and understanding are very much greater at Panama than at Nicaragua. Furthermore, in the estimates made for the work at Panama, provision has been allowed for a great many things which would not have been allowed for, if we had had only the uncertain information given by borings and the like. In one instance it amounts to many millions; rock prices have been used at the Culebra cut with earth slopes; and an exceedingly expensive retaining-wall has been provided, which would have been almost entirely omitted if we had had no further information than what existed before any work was done.

There is another element. It has been considered by many that the limit of time required to complete a great work was the time required for the largest single item of that work. This is perfectly true in a country supplied with labor, with facilities of transportation and other such things as exist in the United States or any of the other settled portion of the world. But it is not the case on the isthmus, where there is practically no working population, where there are no lines of access, where everything must be brought in and everything must be got ready. While some of my colleagues have differed from me, I have not the slightest doubt that in actual practice it will take at least one-quarter longer to build the Nicaragua Canal than to finish the Panama. I might cite, as an instance of this, the construction of our Pacific railroads 30 years ago. Their time could not be determined by the time any great work on the line required. They had to be begun at the two ends and built till they met in the middle. It was slow work at first, gradually hastened. Those roads were built in what was then considered marvellously quick time. They could be built in one-quarter of that time now, simply because we have access to them.

Nicaragua has been supposed to have three special advantages. The first of these is the position of its western terminus. The western terminus of the Nicaragua Canal is more than 500 miles nearer San Francisco than Panama is. That is an undoubted fact and an undoubted advantage that Nicaragua possesses.

The next supposed advantage is in respect to sanitary conditions. Nicaragua has been supposed to be very much more healthy than the Isthmus of Panama, and this is true. But the statistics of mortality are always meagre in a population that consists principally of monkeys, and that is the principal element of the population of the swamps of Nicaragua. Epidemic diseases seldom exist in countries without human population. This is the state of affairs at Nicaragua. The eastern end of the Nicaragua Canal, for a length about equal to the whole Panama Canal, runs through a country with an average rainfall varying from 240 to 300 inches a year. It is something like double the rainfall on the Isthmus of Panama. The friends of Nicaragua have explained the superior healthfulness of this district on the simple principle that it is perfectly healthy to be dry, it is perfectly healthy to be wet; it is very dangerous to pass from wet to dry, and in this region you never have to do it. Perhaps this is true. I will not deny it. But the fact remains that the rainfall is such that that region is a continuous swamp, and that the conditions will be very greatly changed when the swamp is opened and work is carried on. The Isthmus of Panama undoubtedly is a very unhealthy place. It has been inhabited by one of the worst populations of the globe. Its sanitary principles have been conducted in the same manner as in all Spanish-America, where the concealment of filth from the eye, without reference to the other organs, was all that was ever asked for. The experience of the last few years in Cuba is one of the most valuable things which have ever occurred. Cuba, in itself, is probably one of the healthiest islands in the whole world; but it has been made a hotbed of disease simply by the principles which have governed sanitation in Spanish America. The existence of filth in all kinds of places, accompanied by the excursions of the striped-legged mosquito, seems to have been the cause of all the illness in the Island of Cuba. It has undoubtedly been the cause of much of the illness on the Isthmus of Panama. What the actual facts would be if work were undertaken on the two isthmuses, no one can say; but for my own part I feel that it is a case of infection at Panama and a case of malaria at Nicaragua. There is malaria at both places. But I would rather, myself, attempt to wipe out the bad infectious troubles on the Isthmus of Panama than to eliminate the dangers of the swamps at Nicaragua.

The third advantage of Nicaragua has been supposed to be that there a clear title could be obtained without any complications with the vested rights of other parties, and for a time this appeared to be true. The complications at Panama seemed to be of such an aggravated character that there was danger that they would preclude the construction of the canal on what was preeminently its best location. Furthermore, these complications extended, not only to the site of the Panama Canal, but to every possible canal site within the Republic of Colombia. That has been changed. The rights under which the French company has been building this canal are totally inadmissible for the construction of a canal by the United States Government. But they were a cloud on the title; and the offer of the representatives of that company, accompanied by an agreement with the representative of the old, defunct, original company, to join in a conveyance in the nature of an absolute quit-claim of every right and title of any kind on the isthmus, puts the Panama position legally in a much clearer light than the Nicaragua position. It is an absolute quit-claim from every one who has any rights there. At Nicaragua all that our country is offered is the assurance of the Nicaraguan Government that it has forfeited rights which had been granted and had not been used. The title is clearer at Panama than at Nicaragua.

This is simply a general account of the relative positions of the two to-day. The one advantage that Nicaragua has, is that its west end is 500 miles nearer San Francisco than Panama is. And this means much less than it sounds like. If a steamer goes through Nicaragua night and day as fast as it can go, it may be able to get to San Francisco in one less day than it could if it passed through the Panama Canal. But if it runs only by day and lies up at night, the time is equal for the two. And this is the case with freight steamers of moderate speed. A high powered passenger ship, even if it ran night and day, would lose as much time in going through Nicaragua as it would take to make the additional 500 miles if it went through the Panama Canal. Perhaps you may say that fast passenger steamers will not go through there, and that is perfectly true. But the speed of the freight steamer to1day exceeds the speed of the passenger steamer of 30 years ago. Whether such changes will continue, I do not know. You can judge as well as I can. But I mention it merely to indicate the possibilities. I shall say nothing further of the relative merits of the canals; but in all that I say after this,

I shall assume that Panama is the canal which is selected and is the one which will be built.

Going now to a different subject, what are the reasons why a canal should be built? And first, what are the commercial reasons for building a canal? Being a Reform Club, I presume commercial reasons are of secondary consideration to you; but they ought to be considered.

There are several classes of traffic on which the opening of the canal will have very important influences. First of all, there is the trade of the west coast of North America. The construction of this canal will put San Francisco, which may be accepted as the commercial center of the Pacific Coast, and not only that, but the port which almost all business going to any point north of Mexico, whether in America or Asia, will seek—the construction of this canal will put San Francisco within 15 days of New York by a steamer of the same class as the Morgan Line of steamers running between New York and New Orleans; and within 23 days of any English port, by the same class of steamers. I think that tells its story. What it means is that it extends our coasting trade to the whole of our country. It extends it there on practically the same lines that it is now conducted between New York and Boston, between Boston and Baltimore, between New York and Charleston and Savannah, between New York and New Orleans, or between New York and Galveston. That trade would to a certain degree be taken from the present transcontinental railroads. They would lose a business which they do now. But the railroads terminating at our South Atlantic and Gulf of Mexico ports do not seem to suffer from the coasting lines of steamers. In fact, the development which these steamers have rendered possible has been of the utmost benefit to the railroads. It will be the same way if our coasting trade is extended through the Panama Canal to the Pacific Coast. The impetus it will give to the various developments of the California, Oregon and Washington coast will much more than make up for any particular traffic that may be lost. Furthermore, it will have one other effect. Our whole coasting fleet will be available for our entire coast. At present there is one fleet on the Pacific, another fleet on the Atlantic. They cannot go from one to the other. At times it leads to very unsatisfactory conditions, especially on the Pacific Coast.

The next class of traffic which must be considered is that of the eastern coast of the United States; and this both in its connection with the west coast of North America and with the west coast of South America and with Asia. And there comes in a curious thing which those people who have studied geography by maps know little about. If you want to go from Panama to Yokohama and to make a coaling port on the way, there is no other port which is a quarter as convenient as San Francisco. The route from Panama to Yokohama by way of Honolulu is several hundred miles longer than the route by way of San Francisco. Practically all the Asiatic business that goes through the Panama Canal will go to San Francisco. San Francisco will be the coaling port. San Francisco will be the port where mails and passengers will be received. San Francisco will get the benefit of nearly everything belonging to that business, in spite of the freight which goes through by water. So far as business beyond Yokohama and Hong Kong is concerned, the situation is different from what might be supposed. The mouth of the Mississippi River is in longitude 90 deg. west. The mouth of the Ganges is in longitude 90 deg. east. The mouth of the Ganges is directly opposite the mouth of the Mississippi; and the Mississipppi is as far west of London as the Ganges is east. There is no European traffic for the far East, unless for a portion of New Zealand, which will not find a shorter route through the Suez Canal than through the Panama. Starting from New York, Manila is practically a common point. Manila may be reached about as easily by way of Suez as by way of Panama. The Asiatic business which would seek the Panama Canal is the business of the United States with Japan and China. The business of the United States with India and with everything west of the Straits, would find other better routes. That is practically the limit of Oriental business which would seek this canal. And that business would take the northern route and stop at San Francisco.

There are, however, two other classes of business which would go through that canal. The first is the business with the west coast of South America, a business which seems to have great possibilities of development, but in which the United States has hitherto had exceedingly small interests. That west coast is now served by several European lines of steamers, which, passing through the Straits of Magellan, come up on the west coast; while some of them make connections at the isthmus, and transfer. But the opening of this canal will place the west coast of South America 3,000 miles nearer our ports than to those of Europe. It will give us the opportunity to do there what we are doing in Mexico and in the West Indies. It will give us an entirely new field for commerce, and one which may be of the very utmost importance. These classes of traffic are the ones which the canal will open. The canal will also form our best line to New Zealand and Australia. How much business we shall have with those regions I do not know. Many people are familiar with those special traffics. But, at any rate, the principal thing to be observed is that the business which will go through the canal when it is done, must be very largely a business which does not now exist. When our western wheat can be taken to Liverpool in 25 days, instead of 140, we may expect certain results from it, when you consider the less amount of capital which is now tied up, which are otherwise impossible. I cannot help feeling that the traffic through this canal will actually be enormous; and that the present statistics of traffic now existing are no indication of what it will be. Furthermore, it must be a traffic of coarse tonnage, carried at low rates, and which will bear comparatively low tolls. It will not be the same class of traffic that goes through Suez. And it will be a traffic which is likely to require the same changes of rates which have occurred on American railroads. It is a parallel case. No American railroad that I know of could have operated profitably on the business that existed before it was built. And the most profitable railroads have been those which had the least traffic before their construction, whose traffic was only possible because they existed, and whose traffic has continued to increase in profit because the continual decrease of rates has led to a much more rapid increase of volume. That is what I look for in the case of the canal. There are no estimates which are entitled to less consideration than estimates of traffic, made before that traffic comes into existence. And I know of nothing which has fulfilled its expectations in a measure more incommensurate with what they actually were, than the traffics which have been developed under similar conditions.

Another reason why this canal should be built is a political reason, and to this political reason, a great deal of value must be attached. As this is a Reform Club, and not a commercial club, I presume it is busied with political rather than with commercial considerations, and that such considerations here will be given their full weight. And, in the first place, I would say that in all political matters the human element of the problem is very large. Erroneous as commercial calculations are likely to be when made purely as calculations, the error in political calculations made on the same basis is probably much greater. However much may be said about the cost of a canal for political reasons, the voyage of the "Oregon" was an object lesson which has weighed much more with nine people out of ten than any such calculations possibly can. We may figure that the interest on the cost of the canal would build three ships and put them on the Pacific every year, and that in that way we could have a double navy instead of a single one. But, whether that be true or not, it does not meet the condition, and it certainly does not satisfy the public mind. Our government is the first government of the kind the world has ever seen. It has been trying to do something which has never been attempted before. It is conducting the general legislation for the country in all matters to which the general government attends, on the principle of a legislature elected by popular votes in States which are widely separated geographically. We call for and desire, our whole government is based on the principle of, the unity of this government. The danger is, that such unity of government cannot be maintained without a unity of interest. It is of the utmost importance that every step should be taken which we reasonably can take which will further a unity of interest, which will make the interests of the Pacific States identical with those of the Atlantic; the interests of the Southern States identical with those of the Northern. I know of no one thing which will do this as much as the construction of the Isthmian Canal. I feel that this alone is perhaps the strongest reason of all for building the canal, and alone it is a sufficient reason for deciding to do it.

This is not all. The position of our country is one which we know. It has become a great country among other nations. It has become a country of great production and great capacity. It has become a country with rapid lines of transportation and a great many other things of the kind. I feel that this work has been accomplished very largely through my own profession; that the civil engineer, the man who directs the great sources of power in nature for the use and convenience of man, has made the American Republic, as it is to-day, possible. He has not only made it possible, he has made it inevitable. He has brought about a condition which a hundred years ago many of our statesmen were afraid of. But he has brought it about in a way in which it could not possibly be avoided. We can no more step back of that condition than we can live again in the sixteenth century. It is an absolute fact which must be accepted and which we must work under. It has primarily been rendered possible by the engineer; but it is a work in which the merchant, the traveler and a great many other people have had their part, a work which is being done and which will continue to be done. This club, as I believe has been said before, is a Reform Club. The reformers have been the radicals of the world, they have not been the conservatives. I suppose I may therefore assume that the object of this club is to be in advance of the ideas of the people and to set a pace perhaps a little too fast, but never too slow. The conditions under which the country now lives must be accepted, they cannot be reversed. Our acts must be such as will make the very best terms out of what exists, and bring about the very best possible results. And, from this point of view, we require the canal. We require it for our foreign trade development. We must have a market for our goods. We must be able to reach that market. The construction of the canal will practically put us as near as any European nation is to all the world excepting Europe and the western part of Asia. That is one reason why we need it.

And then we need it for another reason. We need it, not merely to make a market for our goods, but to develop the kind of trade we need and to develop it in the way in which our country will prosper most. I know of no single agency which will bring about the graduation from our economic education more quickly than the Isthmian Canal. And by economic education, I refer to tariffs and matters of that kind. I have always believed in protection. I have been a protectionist and am to some extent now, but I look upon protection in the same way that I look upon education. It is justifiable because it leads to something else. A college training is valuable for the after life, but the boy who after going to college devotes his whole life to the acquiring of an education which he does not use, makes a very poor citizen. When protection has established a business which no longer requires it, it should be withdrawn. A business which can never be expected to live without protection should never be protected. We are now the leading iron manufacturers of the world; protection has hastened this result by many years and has done a good work, and that work is now completed. There are some things which we can make better or cheaper than countries in any other part of the world, and it is our interest to find a market for these goods. There are other things which we can never make as well as or as cheaply as some other nations can, and it is for our interest to be a market for these goods. A market for the articles in which we usually excel will be found in countries west of the Pacific and on the west coast of South America. All those countries are eminently capable of producing articles which it is not natural for us to make; if we cannot get this foreign trade we need a protected home market for our manufacturers; if we can get this trade where we can sell that which we can make best we shall be in a position to buy to best advantage that which we can produce only under difficulties. This means breaking down the policy of isolation. We have already started in this way and we are talking about reciprocity. From this point of view I know nothing which will bring about such a result sooner than the construction of an Isthmian canal will. It will put us in communication with all portions of the world where we can sell as well as buy. Armed with the diploma of a protective education we shall be ready for free trade.

That is all I have to say about the character of the canal and the reasons why it should be built. There is one other aspect on which I wish to touch. And that is, how should it be done? And in this matter I think the experience of the Spanish War and since then has been of the utmost value to us. I believed in the Spanish War. I was always in favor of it. There are many reasons which I see now why it has been good for us, and this is one; it has taught us how to occupy a tropical country, how to handle that country and how to get good results. We took the Island of Cuba, a pest-hole of yellow fever. After three years, the amount of sickness among American soldiers in Cuba is much less than it is in the United States. The Panama Railroad was built when sanitary principles were not known and when little care was taken; and there was an enormous loss of life and a terrible name given to the isthmus. The French Company began constructing the canal, and imported into the isthmus many of the luxuries and vices of their northern capital, and the death rate was renewed. The city of Panama is a pest-hole; but it has never been as bad as Santiago de Cuba formerly was; and there is no reason why Panama should not be as healthy as Santiago de Cuba is now. The first condition is, that there must be an absolute military occupation of the isthmus, with the same control for police sanitation and everything else, that we have had in Cuba. Panama is not naturally a healthy country, as Cuba is. But it is not any worse than nor so bad as the St. Francis bottom nor the Sunflower country, with which we are all familiar and which are in the heart of our own country. That military occupation must extend to everything which influences health, to police and other regulations; and it must be continued during the whole construction of the canal. I do not believe there are any men in the world as capable of making that military occupation efficient and good in its results as the men who have been trained in our own army in the Cuban occupation.

Then the work must not be started too soon. Two years at least should be consumed in preparation. Get ready thoroughly before you begin. I fully believe that with two years spent in preparation, the canal would be open three years earlier than if only one was spent. Those two years of preparation would be required for the detail surveys, the complete plans, the complete specifications, the complete organization for carrying on the work, and especially for the general cleaning up required for sanitation. The filth of 400 years must be taken from under the houses and dumped somewhere in the Pacific or the Atlantic. The isthmus, which has been occupied for 400 years, practically has not a water pipe on it. There is plenty of good water on the isthmus, excellent water, but it must be brought to the towns and to every place there; and people must be compelled to use it instead of drinking from the swamps. This kind of work must be done throughout and everything should be in shape before the actual laboring force is brought there, before the work is begun. Panama is an old city, built at the head of a bay with an enormous tide. We may be confronted there with some of the same sewage problems that were handled in Boston, only it is a city of 20,000 people instead of half a mil-

lion, and the tide is so great that the discharge from the sewers can be conducted without any pumping, by simply letting it out on the turn of the tide. There is no reason why it should not be done at comparatively small cost, especially as there is no expense to get below frost. Colon is a smaller place, but naturally a worse place. It is practically built on a swamp. It is a miserable town. Perhaps it had better be burned up, and another town built at a higher level after grading it up. That is a detail to be determined hereafter. If that course were adopted, the buildings are not sufficiently valuable to make the expense of the conflagration unreasonable. There is a moderate amount of swamp in the first ten miles south of Colon. There is some swamp back of Panama. These swamps will undoubtedly have their evil influences. There will be some malaria. You can get rid of yellow fever. And perhaps by that time we can get rid of malaria. But without any doubt, under proper conditions, the mortality during the work there can be kept within very reasonable limits. The mortality there during the work, if the work was properly conducted, I believe would be less than the mortality in some northern cities in the most healthy locations, in which sanitary provisions are all neglected.

The climate is an enervating one. It has a large rainfall, though not excessive for the tropics. It is about half of what it is on the eastern side of Nicaragua. All those things have their influence; but they must be regarded rather as warnings of the necessity of thorough preparation than as deterrents from carrying through the work.

The laborers must be imported. The work must probably be done almost entirely by contract. This would be especially the case in government work.

It is work which requires a new outfit throughout. The largest outfit ever provided for any public work is now rusting on the Isthmus of Panama. In my judgment it would be a mistake to require a contractor to use a single particle of that outfit. It is 20 years old. Assuming it to be in perfect condition, to be as good as when it went there, how much is any machine worth which is 20 years old? You cannot afford to take it for a gift if you are required to use it. I would rather have, myself, the isthmus entirely without that machinery, for it may cost more than it was worth to get it out of the way.

The sources of labor will be probably very largely the West India Islands. But the two years which ought to be given to consideration and to preparation, to getting things in order, will give time to settle these matters. We have contractors in this country who are abundantly able to carry out that work if they are backed by capital, and they would be.

How long it would take to do the work is a matter of conjecture. It will depend on some things which we cannot control. But with two years of preparation, I have no doubt, myself, that the following eight years would be ample to carry the work through; and that, with the preparation and the efficient management which I should hope would be obtained, it will be possible to finish the work for less than the estimates which the Commission has made.

A Review of Alloys.*

The ordinary method of obtaining alloys is by melting together the different constituents. However, alloys can also be obtained by subjecting the powders of the constituent metals to strong compression. It has furthermore been found that the molecules of metals penetrate each other when in contact, at temperatures far below the melting point of either of the constituents, some time to be alloyed with quantities of the above metals, the amount of which in the lead decreases with the distance from the plane of contact. That metallic alloys can be obtained by electro-deposition from their solutions is a well-known fact, but hardly applied otherwise than for purposes of electroplating.

In combining different metals with each other, a few rules may be laid down regarding the qualities of the alloy, though it must be stated that, like most rules, they do not apply absolutely to every case. By adding one metal to another, the strength of the latter is generally increased up to a certain point dependent upon the nature of the metal added. After going beyond this limit, a decrease in strength takes place again, frequently very rapidly, unless the metal added possesses greater strength than the one to which it has been added. Tin, aluminum or zinc added to copper are examples of the correctness of this rule. By adding a third metal, not infrequently a further increase in strength can be accomplished. The hardness of a metal also generally increases by adding another metal. An alloy of 95 per cent. copper and 5 per cent. tin possesses double the hardness of pure copper. The ductility of metals is generally greater, the purer they are. The temperature is of some influence; copper and zinc are more ductile at a high temperature, while the ductility of brass and German silver decreases with a rise of temperature. The fusing point of a metal is generally lowered by alloying it with another. Alloying one metal with another in most cases decreases the conductivity for heat and electricity.

Copper and tin will unite to form homogeneous alloys in a wide range of proportions. As tin is added to pure copper the color of the alloy gradually changes, becoming decidedly yellow at 10 per cent., and turning to gray as the proportion approaches 30 per cent. In the researches conducted by the author, it was found that good alloys contain as much as 20 per cent. tin. When the color changes from golden yellow to gray and white, the strength as suddenly diminishes; and alloys containing 25 per cent. tin are valueless to the engineer; nevertheless, this alloy and those containing up to 30 per cent. show compressive resistances increasing to a maximum. Under 17.5 per cent., the elastic limit lies between 50 and 60 per cent. of the ultimate strength; beyond this percentage the proportion rises, and at 25 per cent. tin the elastic limit and breaking point coincide. Passing 40 per cent. tin this change is reversed and the elastic limit, although indefinite, is lowered until pure tin is reached and a minimum at about 30 per cent.

The bronzes useful to the engineer contain between 85 and 91 per cent. copper and 15 to 9 per cent. tin. A small addition of a deoxydizing agent like phosphorus, silicon, manganese, aluminum greatly increases the strength of a bronze. Copper and zinc together form brass, which is usually made nearly in the proportion copper 66⅔, zinc 33⅓.

Brass may be made tough or soft, hard or brittle, strong or weak, elastic or inelastic, dull of surface or lustrous as a mirror, friable or nearly as malleable and ductile as lead, as may be desired, by varying its composition. No known material, perhaps not even excepting iron, can be given so wide a range of quality or so wonderful a variety of uses. All the common varieties are composed of 67 to 70 parts copper and 33 to 30 of zinc. A little lead is often added to soften and cheapen it and tin in small proportion to strengthen it. The copper-tin-zinc alloys or kalchoids (from the Greek "kalchos," indicating bronze or brass) are of great value, and include the strongest and probably the hardest possible combinations. They are in most respects, usually, intermediate between the brasses and the bronzes obtained by uniting two metals.

On making a large series of tests with compositions of the three metals named, Professor Thurston finally arrived at the conclusion that the best alloys for purposes demanding toughness as well as strength lay between 58 and 54 per cent. copper, 44 and 40 per cent. zinc, and 2½ and ½ per cent. tin. It was found that the strongest of bronzes contained 57 per cent. copper, 1 per cent. tin, and 42 per cent. zinc; however, an alloy of the composition 56 per cent. copper, 2 per cent. tin, 42 per cent. zinc is likely to prove more generally useful, in consequence of its greater ductility and resilience, and alloys with a little less tin may often prove better than that. The safest alloys under shock are those containing the smallest quantities of tin. By far the most ductile alloy of this series tested contained no tin at all and had the composition 57 per cent. copper and 43 per cent. zinc.

A discussion on the properties of alloys would be incomplete were the influence of small quantities of impurities upon metals not considered in this connection. We all know of the deleterious effect which small quantities of phosphorus and sulphur exert upon the quality of iron and steel. One-tenth of a per cent. of antimony, bismuth or arsenic in copper or brass will make it absolutely impossible to roll these metals into sheets, due to their cracking under the rolls. The electrical conductivity of copper is materially diminished by minute quantities of impurities; on the other hand, it has been found by the "Alloys Research Committee" that a small quantity of arsenic is actually beneficial in copper used for fire-boxes and staybolts. Two-tenths of a per cent. of lead, bismuth or antimony added to gold will make this most ductile of all metals so brittle that it can be shattered with the greatest of ease; a small quantity of arsenic in tin will transform this soft metal into a very hard and brittle one, etc.

I wish to add here a few observations made in my laboratory as regards the influence of small quantities of impurities upon the qualities of certain antifriction metals. A small quantity of zinc, from $^{5}/_{100}$ to $^{1}/_{10}$ of a per cent., in a lead-antimony-tin-alloy, will greatly interfere with the obtaining of clean castings, due to the great tendency of forming oxides or drossing. A similar phenomenon is caused by the presence of $^{1}/_{10}$ to $^{2}/_{10}$ of a per cent. of iron in a tin-copper-antimony alloy. A small quantity of arsenic in either of these alloys will cause large, lammellar and brittle crystals to be formed, which make the metals useless for the purposes they are intended for.

An attempt will now be made to show how considerations along lines as indicated above have contributed to our understanding of the nature of alloys. We all know that by dissolving common salt in water we lower the freezing point of the water. By increasing the amount of salt the freezing point of the resulting mixture is at first correspondingly lowered until it contains a certain percentage of salt. The lowest possible freezing point of a solution of salt in water is then reached and further addition of salt will gradually raise the freezing point of the brine. Dr. Guthrie found that the mixture which has the lowest possible freezing point contains about 23.5 per cent. of salt. He proposed for it, and for all similar mixtures, i.e., for all saline solutions of lowest freezing points, the name of *cryohydrate*, by which he meant to imply that they can only exist in a solid state at low temperature.

The present theory of the constitution of alloys, worked out on the basis of the theory of solutions, ranges them into three classes: 1. Alloys which give neither definite compounds nor isomorphous mixtures. 2. Alloys which form definite compounds. 3. Alloys which form isomorphous mixtures. Into the first group belong the alloys of lead and antimony, lead and tin, copper and silver, etc.

Taking the curve of fusibility of antimony and lead as an example, we find that the lowest fusing point lies at 228 deg. C. with a composition of 13 per cent. antimony and 87 per cent. lead.

The similarity between this curve of fusibility and the curve of solubility of a saline solution is obvious. If a molten alloy of lead and antimony containing less than 13 per cent. antimony is allowed to solidify slowly, lead will first start to crystallize out until the temperature has fallen to 228 deg. C., when the temperature will remain constant, until the total mass of the alloy is solidified. If, on the other hand, more than 13 per cent. of antimony is present in the alloy, the antimony will solidify first until on cooling to 228 deg. C. the lead and antimony will solidfy together in the proportion of 87 to 13. From this may be easily observed the absolute similarity between the cryohydrate and the alloy of the lowest possible melting point, and for this latter Dr. Guthrie has proposed the name *eutectic alloy*.

Into the second group, alloys which form definite compounds, belong the tin-copper, antimony-copper, aluminum-gold, aluminum-antimony alloys and others.

In the case of alloys containing less than 25 per cent. of copper, pure crystals of antimony are separated when solidification begins, increasing gradually in size as the temperature decreases; the portion remaining liquid, therefore, gradually becomes richer in copper until the composition of the eutectic alloy is reached; it then solidifies, at a constant temperature, through a simultaneous crystallization of antimony and $SbCu_2$. In the case of alloys containing from 25 to 60 per cent. of copper, a similar phenomenon occurs, only it is the definite compound $SbCu_2$, which separates from the molten mass as soon as the freezing point is reached. When from 60 to 70 per cent. of copper is present, the same compound is separated, but is in this case surrounded by a second eutectic alloy made up of copper and the compound $SbCu_2$. Finally, when more than 70 per cent. of copper is present, a portion of the latter is first deposited when solidification sets in, until the portion remaining liquid has reached the composition of the second eutectic alloy.

In the third group, alloys which form isomorphous mixtures, belong the alloys of silver and gold and of bismuth and antimony. The curve of fusibility of these alloys is the simplest imaginable, consisting nearly of a straight line drawn between the two melting points of the respective metals.

In this case there is no eutectic alloy, as the whole mass solidifies at a constant temperature, which is a function of the composition.

All these conclusions drawn from the curves of fusibility have been corroborated by microscopic and analytical evidence, and a very large number of beautiful photomicrographs have been published by the above named investigators. It might be mentioned in passing that the joint application of caloric and microscopic methods of investigation on iron and steel have contributed greatly to our understanding of the molecular constitution of these metals, the changes of the molecular arrangement on tempering, etc.

Bearing Metals.—A group of alloys of especial interest to the railroad man are the bearing metals. In 1892 Dr. Dudley published a report in which he condemned the use of gun bronze, quite generally employed in axle bearings at that time, and advocated the substitution of it by a bearing containing besides copper, tin and a small percentage of phosphorus, a quantity of 10 to 15 per cent. lead, on the grounds that such an alloy was very much less liable to heating than cannon bronze and wore about 50 per cent. less.

The conclusions he drew from a large number of tests were the following: 1. The loss of metal by wear under exactly the same conditions diminishes with the increase of lead. 2. The loss of metal by wear diminishes with the diminution of tin. 3. Phosphorus in a copper-tin-antimony alloy is more valuable in the foundry than in service. Its principal value lies in the help it gives in getting sound castings.

Dr. Dudley then proceeds to state that it is impossible to use white metal alloys for solid bearings, on account of the distortion they suffer in service due to their plasticity, but he adds if provided with a stiff backing there is no reason why they should not give very satisfactory results.

The latest and most extensive work on antifriction alloys was published in 1898 in a very comprehensive paper by Dr. Charpy, in which he describes how, with the aid of the microscopic structure of the metals, the curves of fusibility and tests of compression, he was able to determine the composition of alloys best adapted for the purposes of antifriction metals. His manner of reasoning was as follows: Experiments have demonstrated very conclusively that the coefficient of friction in the case of a well-adjusted bearing depends exclusively upon the nature of the lubricant, regardless of the metals in contact. Furthermore, while for small loads without lubrication the coefficient of friction is practically constant, it increases in proportion to the pressure up to a certain point, above which the increase is very rapid, the surfaces rubbing together producing heat and finally cutting. Theoretically all bearings should be as hard as possible, as they will bear the heaviest load without materially increasing the coefficient of friction. In practice, however, bearings of this kind would be absolutely useless, as a constantly perfect adjustment cannot be ob-

*Extracts from a paper presented before the April meeting of the Western Railway Club by Gustav Thurnauer, Ph. D., Aurora Metal Co.

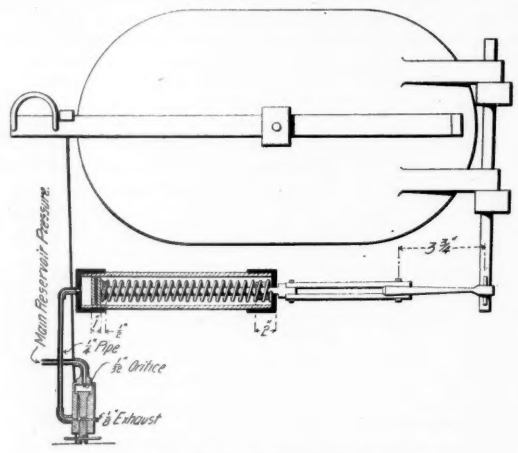
tained, and therefore a certain plasticity of the bearings is necessary. Alloys used for bearings should therefore have two apparently contradictory properties, i.e., hardness and plasticity. Such properties can be obtained in white metal alloys composed of hard grains imbedded in a plastic cement. All alloys used for antifriction purposes should possess the same general characteristics; they should consist of hard grains imbedded in a plastic alloy. Such constitution may be produced in binary alloys, the hard grains being made up of a single metal such as antimony. It is generally preferable, however, to use ternary mixtures, because, owing to the complex composition of the cement, the constitution possessing the required qualities may be more readily obtained. Such alloys are the tin-antimony-copper alloys (genuine babbitts) and the lead-antimony-tin alloys, both of which have been found empirically to be best suited for the purposes of antifriction metals. [This monograph is accompanied by a number of illustrations of value in properly developing the subject. These we do not attempt to reproduce. The study will soon be available complete in pamphlet.—Editor].

A Pneumatic Fire-Door Opener.

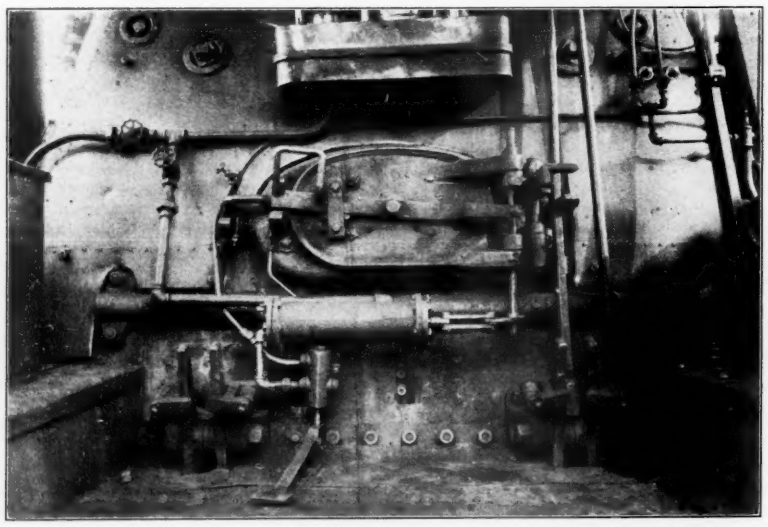
Mr. F. L. Brewer, an engineman on the Rock Island, has invented a device for opening and closing the fire-door of a locomotive. The only action required by the fireman is to press his foot on a pedal when he wishes the door to open and remove the pressure to allow it to close.

As will be seen by the illustrations the apparatus is simple and of few parts. A cast-iron cylinder 2½ in. inside diameter and 14 in. long is bolted to the boiler horizontally just beneath the fire-door by two brackets which are an integral part of the casting. The drawing shows the original design, having the two heads threaded on the cylinder; this has been modified as shown in the engraving from the photograph, flanges being provided and heads bolted on. The piston is of steel, having two ¼-in. cast-iron packing rings. The rod, which is ¾ in. in diameter, is enlarged at its outer end and shouldered into a crosshead, to which is attached a toggle-joint, connecting with a 3¾-in. crank, keyed to the door-hinge shaft. The shaft is keyed to the door-half of the upper hinge and has a set-screw through the lower one, insuring a rigid attachment.

The valve is simple in form and seats by gravity. Above the valve is a small chamber which is in pipe connection with the main reservoir; the air enters this chamber through an orifice $^1/_{32}$ in. in diameter. The stem of the valve extends down through the casing, projecting ¼ in. or more below. The inner end of the operating pedal is directly beneath this stem and a depression of ½ in. at the outer end raises the valve clear of the seat, permitting the air to pass down through the small hole parallel to the valve stem and just to the left of it, and out through the pipe connection to the cylinder, which it enters through a ⅛-in. orifice. The piston has a 6-in. stroke which is sufficient to throw the door wide open.



Pneumatic Fire-door Opener—Sectional View.



Brewer's Pneumatic Fire-door Opener.

The air pressure acts against a flat-steel helical spring which operates to close the door the moment the air is released. The exhaust is through the same orifice in the cylinder that admits the air and the throttling action of this opening provides a cushion for the spring pressure to act against, preventing the door from slamming. The exhaust reaches the atmosphere by passing around the valve stem through a ⅛-in. groove turned in the stem and thence through a ⅛-in. hole drilled in the casing.

Just back of the valve casing, with its lower end resting on the pedal, is a small steel rod held against the boiler head by suitable guides. Its upper end is in contact with a small latch which holds the door closed. This latch is raised simultaneously with the admission of the air. It is hinged to the boiler head and is cut under at its outer end so that when the door swings shut this small latch is raised and drops into place over the door latch.

With a $^1/_{32}$-in. admission port the minimum pressure under which the device will work rapidly and easily is 60 lbs. With a lower pressure than this the action is too slow to be satisfactory. This can, of course, be regulated by varying the size of the admission orifice.

The device is in use on two Rock Island passenger engines, Nos. 1,301 and 1,303, in the fastest service on the road, and on No. 1,454, a wide fire-box, 10-wheel freight, which is the largest engine on the road. The mechanical department of the Rock Island has been very carefully watching the results from the use of the door opener and recently asked the firemen on the engines equipped with the device for an expression of opinion as to its working, and whether or not it would effect a saving of fuel, lengthen the life of the fire-box, and cause a reduction of leaky flues. The replies were without exception very favorable. It was stated in every case that besides working perfectly, the fireman is able to put in a fire in about one-half the time required by the old method. These opinions have been substantiated by the traveling engineer and by Master Mechanic Stocks. The reports were also unanimous in the opinion that there was a saving in fuel, although no tests have been conducted to determine to what extent this is true. Other points mentioned were, that the engines steamed more freely, the black smoke is reduced, and the use of a second fireman on large engines would be rendered unnecessary. Mr. Brewer has applied for a patent on the device.

Train Accidents in the United States in March.†

Note.—An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

bc, 1st, 5 a.m., Seaboard Air Line, Elberton, Ga., collision between a passenger and a freight train, both running at good speed. Both engines and several cars were wrecked and four employees were injured.

bc, 1st, 9 p.m., Cleveland, Cincinnati, Chicago & St. Louis, Ashmore, Ill., butting collision of freight trains, one of which was standing at a water tank. Three engines were badly damaged. One of the firemen was buried beneath the coal in his tender and was confined there, out of sight, for half an hour, while the other trainmen were looking for him. He was conscious, and called for help, but the sound of his voice was drowned by the noise of the whistle of the engine, which was blowing continuously. The fireman finally dug his way out, unaided.

*xc, 1st, Southern Pacific, Suisun, Cal., a passenger train collided with two freight cars which had been blown on to the main track by a high wind, and the engine was damaged. One of the freight cars took fire and was burnt up.

unf, 1st, New York Central & Hudson River, Philmont, N. Y., a freight train was derailed at a washout and the engine and four cars were ditched. Three trainmen were killed.

unf, 1st, Narragansett Pier Railroad, Kingston, R. I., a passenger train was derailed at a washout and the tender and one passenger car were ditched.

unf, 1st, Baltimore & Ohio, Toll Gate, W. Va., a freight train was derailed by running into a washout, and 12 cars fell down a bank. The fireman was injured.

unf, 1st, Southern Railway, Atlanta, Ga., a mixed train broke through a trestle bridge, making a bad wreck. Four trainmen were injured.

*rc, 2nd, Wisconsin Central, Cylon, Wis., rear collision of freight trains, wrecking several cars. The wreck took fire and was partly destroyed. One trainman was injured.

xc, 3rd, Chesapeake & Ohio, Haxall, Va., collision of freight trains, badly damaging one engine and several cars. One brakeman was killed and another fatally injured.

xc, 3rd, Louisville & Nashville, Pulaski, Tenn., collision of freight trains at a meeting point, in consequence of the misplacement of a switch; both engines were wrecked; one fireman was killed and three other trainmen were injured.

*xc, 3rd, Southern Pacific, Ivy, Texas, a passenger train ran over a misplaced switch and into some freight cars standing on a side track. Four passenger cars were derailed and one of them was overturned. Three freight cars and their contents were destroyed by fire. Three trainmen and one passenger were injured.

o, 3rd, Southern Pacific, Guadalupe, Cal., the locomotive of a freight train was wrecked by the explosion of its boiler, and the engineman and fireman were killed. A brakeman was fatally injured.

unx, 4th, Seaboard Air Line, McKinney, Va., a freight train was derailed and five cars were wrecked. A brakeman was injured.

†unx, 4th, Central Vermont, Cambridge, Vt., passenger train No. 23 was derailed, and two cars were overturned. One passenger was fatally injured and several others were bruised.

rc, 5th, St. Louis, Iron Mountain & Southern, Boughton, Ark., rear collision of freight trains. One man killed and one injured.

bc, 5th, St. Louis & San Francisco, Fontana, Kan., butting collision of freight trains, one of which was drawn by two engines. Three engines and 14 cars were wrecked, and a brakeman was killed.

bc, 5th, night, Chicago & Alton, Higbee, Mo., butting collision between a fast freight train and a water train. The engine of the latter was backing and displaying no headlight. Both trains were going at good speed and one fireman was killed.

†*unx, 7th, 3 a.m., Southern Pacific, Maxon, Texas, westbound passenger train No. 9 was derailed while running at about 24 miles an hour around a 9 deg. curve; and the engine, tender and eight cars were wrecked, most of them being ditched. The wreck took fire at once from the engine and was entirely burnt up; one car at the rear, which was not derailed, being the only one saved. Nine passengers and two trainmen were killed and 47 passengers were injured, most of them slightly. The bodies of the passengers killed were destroyed by fire. The cause of the derailment could not be discovered.

unx, 7th, Choctaw, Oklahoma & Gulf, Bridgeport, Okla. T., a passenger train was derailed and the engine and four cars were overturned. Many passengers were injured.

*bc, 8th, El Paso & South Western, Bisbee, Ariz., collision between a special train and a freight, wrecking one caboose and an officers' car, which took fire (from the explosion of the headlight, it is said) and were both burnt up. One fireman was injured. It is said that the freight was wrongfully running on the time of the special train.

xc, 8th, Atlantic Coast Line, West, S. C., passenger train No. 17 ran over a misplaced switch and collided with a switching engine. The passenger engineman was killed and a fireman injured.

unx, 8th, New York Central & Hudson River, Tupper Lake, N. Y., a freight train was derailed and several cars were ditched. The fireman was killed and the engineman injured.

o, 8th, Fremont, Elkhorn & Missouri Valley, Buffalo Gap, S. Dak., the locomotive of a passenger train was badly damaged by the breaking of a side rod, and the engineman was badly injured. The fireman, to save himself, jumped off the engine. The accident ruptured the air-pipe so that the brakes were automatically applied and quickly stopped the train.

dn, 9th, Chicago, Rock Island & Pacific, Neola, Iowa, the engine of a fast mail train was derailed at a derailing switch at the approach to the crossing of the C. M. & St. P. and fell down a bank. Engineman and fireman were injured.

rc, 10th, Baltimore & Ohio, Indian Head, Pa., passenger train No. 16 ran into the rear of passenger train No. 46, damaging the engine and several cars. Ten passengers were injured.

bc, 10th, 1 a.m., Louisville & Nashville, Shepherdsville, Ky., butting collision of freight trains, wrecking both engines and six cars. Three trainmen were injured.

*xc, 10th, at Ironton, Ohio, collision between a passenger train of the Cincinnati, Hamilton & Dayton and a freight train of the Norfolk & Western, badly damaging both engines. The mail car took fire and the whole of its contents was burnt up. The mail agent was injured.

unx, 10th, Alabama & Great Southern, Keener, Ala., a freight train was derailed, making a bad wreck. The engineman was killed and two trainmen were injured.

xc, 11th, Southern Railway, Manassas, Va., passenger train No. 14 collided with some coal cars which had been wrongfully left standing on the main track, and the engine and several cars were badly damaged. The fireman was killed and the engineman and one passenger were injured.

unx, 11th, Burlington & Missouri River, Fort Crook, Neb., a sleeping car in a passenger train occupied by soldiers was derailed while switching and fell down a bank, being overturned. Eight of the soldiers were injured.

rc, 12th, Baltimore & Ohio, Glen Easton, W. Va., a freight train was run into the rear by a following freight and two cabooses and four cars were damaged. One brakeman was killed and another was injured.

o, 12th, Illinois Central, Wesson, Miss., a southbound passenger train was struck by a cyclone, and all of the windows on the west side of the train were broken. The conductor said that he did not know whether the windows were broken by the wind or by the lightning which accompanied the storm.

dr, 13th, Missouri Pacific, Fortuna, Mo., a mixed train was derailed by a broken rail and one baggage car and one passenger car were overturned. Two trainmen and 20 passengers were injured.

*xc, 14th, New York, Chicago & St. Louis, Knox, Ind.,

†Accidents in which injuries are few or slight and the money loss is apparently small, will as a rule be omitted from this list. The tabular record of totals is no longer kept, as a more complete report of the total number of accidents is published by the Interstate Commerce Commission. The classification of the accidents is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defect of roadway.
eq	Derailments; defect of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

a passenger train ran over a misplaced switch and into some freight cars standing on a side track. The engine, baggage car and six freight cars were wrecked. The wreck took fire and was mostly burnt up. Four trainmen were injured.

unx, 14th, Texas & Pacific, Marshall, Texas, a freight train was derailed and nine cars broke through a trestle bridge. One brakeman was killed and two trainmen and a tramp were injured.

xc, 15th, Cumberland Valley Road, Martinsburg, W. Va., a freight train descending a grade broke in two and the rear portion afterward ran into the forward one, making a bad wreck. Three trainmen were injured.

xc, 16th, Mobile & Ohio, Oraville, Ill., a freight train broke in two; the rear portion afterward ran into the forward one, wrecking 12 cars. One man was killed and three injured.

unx, 16th, 11 p.m., Southern Railway, Kyana, Ind., a freight train running at high speed was derailed, and the engine and several cars were ditched. The fireman and one brakeman were injured.

o, 16th, Oregon Short Line, Minidoka, Idaho, a passenger car in a passenger train caught fire, from some cause unexplained, and was entirely destroyed, the fire having burnt some time in a closet before it was discovered by the persons in the car. When the fire was discovered the apparatus for giving the stop signal to the engine was found to be inoperative, and the train was not stopped until it had run more than a mile.

eq, 17th, Lake Erie & Western, Bluffton, Ohio, a freight train was derailed by a broken truck and 10 cars were ditched. A brakeman was injured.

19th, Chesapeake & Ohio, Richardson, Ky., a freight train broke through a trestle bridge, making a very bad wreck. The engineman was killed and two other trainmen were injured.

*xc, 19th, Pennsylvania Lines, Girard, Ohio, collision between a freight train and a work train, wrecking one caboose, which took fire and was burnt up. Eight men sleeping in the work train caboose were injured; two of them fatally.

xc, 20th, 1 a.m., New York, New Haven & Hartford, New Milford, Conn., a freight train slowly approaching a side track broke in two and the rear portion immediately afterward ran into the forward portion, pushing it violently forward a short distance. A brakeman of the train, who was in front of the engine, going to the switch, was run over and killed. Two cars were wrecked.

bc, 21st, Southern Pacific, Cade, La., butting collision between a passenger train and a pay train, both running at good speed. Both engines were badly damaged and both enginemen were injured.

*unf, 23rd, 4 a.m., Southern Railway, Covesville, Va., passenger train No. 38, northbound, was derailed by a landslide, and the engine was ditched. The wreck took fire and seven cars were burnt up. The loss of mail in the mail car was very large. One trainman and one trespasser were killed, and 10 trainmen and mail clerks were injured. A number of the injured were burnt, one of them fatally.

bc, 24th, Pittsburgh, Fort Wayne & Chicago, Youngstown, Ohio, butting collision of freight trains, wrecking both engines and many cars; both firemen, one brakeman and one switch tender were killed, and three trainmen were injured. There was a dense fog at the time.

unx, 24th, St. Louis & San Francisco, Francis, Ind. T., a passenger train was derailed and four passenger cars were ditched. Four passengers were injured.

o, 24th, 3 a.m., Southern Pacific, Lake, Utah, the locomotive of a freight train was wrecked by the explosion of its boiler. Three trainmen and one tramp were killed.

xc, 25th, Baltimore & Ohio, Hickman Run, Pa., a passenger train ran over a misplaced switch and collided with a switching engine; one passenger and two trainmen were injured.

xc, 25th, 8 p.m., New York, Ontario & Western, Norwich, N. Y., a freight train descending a steep grade broke in two, and the rear portion afterwards ran into the forward one, wrecking 15 cars. Two trainmen were injured.

eq, 25th, Atchison, Topeka & Santa Fe, Galisteo, N. Mex., a freight train was derailed by a broken axle and nine cars were ditched; two tramps were killed and three injured.

[illegible]th, Illinois Central, Farina, Ill., a car in a freight train was derailed by a broken wheel and several cars were ditched. One employee was injured.

unf, 25th, Chesapeake & Ohio, Whitcomb, W. Va., a freight train was derailed by a rock, which had fallen upon the track, and the engine and several cars fell down a bank. The trainmaster, riding in the engine, was fatally injured.

un, 28th, Chicago & North Western, Woodbine, Iowa, a freight train was derailed and a man stealing a ride was killed.

bc, 30th, 3 a.m., Baltimore & Ohio, Casselman, Pa., a westbound passenger train collided with an eastbound freight train, badly damaging the engines and several cars; three trainmen were injured.

unx, 30th, Philadelphia & Reading, Reading, Pa., a switching engine was derailed and overthrown; five employees were injured, one of them being fatally scalded.

bc, 31st, 9 p.m., Illinois Central, Millington, Tenn., a passenger train ran over a misplaced switch and collided with a freight train, derailing and damaging nearly all the passenger cars. Several passengers and one fireman were injured, the latter fatally.

eq, 31st, Macon, Dublin & Savannah, Macon, Ga., a freight train was derailed by the breaking of the flange of a wheel, and many cars were ditched. Twelve linemen, riding in the broken car, were injured; two of them fatally.

du, 31st, Central of New Jersey, Wilkesbarre, Pa., a freight train became uncontrollable on a descending grade, and the engine and many cars were derailed and wrecked and thrown down a bank. The engineman was killed and the fireman injured.

Laws Regulating the Employment of Men in the Railroad Service.

The report made to the American Railway Association at its last meeting on this subject, and which was referred to in the account which we printed last week, gives extracts from the laws of Alabama, Colorado, Georgia, Massachusetts, Michigan, Minnesota, New York, Ohio and Vermont; and it is stated that in the other States no laws exist respecting examination of men for employment in railroad service. The whole of the extracts given fill scarcely more than a page.

A list of six subjects covers the whole of the statutes quoted. These, with the States in which they are found are as follows:

Forbidding the employment of persons addicted to the use of intoxicating liquors; Michigan, New York, Ohio, Vermont.

Age and experience of telegraph operators; Colorado, Georgia, New York.

Forbidding employment of illiterate enginemen; Minnesota, New York.

Prescribing experience of conductors, enginemen and rear brakemen; Ohio.

Color-blindness; Massachusetts, Ohio.

Requiring general examination, and issue of license; Alabama.

Metallography in Making Car Wheels.*

BY ASA W. WHITNEY.

In a recent issue of *The Iron Age* William Fawcett presents views in regard to "The Necessity of the Betterment of the Chilled Cast Iron Car Wheel," hinting at the long-threatened but never accomplished supremacy of the steel wheel, which, however, even in foreign countries has had to yield some ground.

It is indeed fortunate that in the strong, but soft, heavy and expensive steel wheel we have a safeguard as against degeneration of the cast-iron wheel, and an incentive in the greater uniformity of steel to the adoption of at least as much metallurgical science to chilled iron as has been applied to steel.

The more profoundly the field of the "iron-carbon" series is studied with modern facilities the more practically important become the relations, chemical and structural, between all its commercial gradations. In this connection I would urgently refer all iron founders to Prof. H. M. Howe's able summary of this matter, entitled "Constitution of Cast Iron," practically closing the last Franklin Institute "Discussion on Cast Iron," January, 1901 (American Institute of Mining Engineers, Vol. 1901), reprinted in the *Metallographist* of July, 1901.

While noting an obvious excuse for bad wheels, Mr. Fawcett appears to put undue emphasis on his limits for sulphur and phosphorus. I know that many excellent wheels are made with sulphur as high as 0.10 per cent., and as much as 0.40 per cent. phosphorus is compatible (the composition being in other respects properly adjusted) with superior strength and service. A lower limit for either of these elements is, of course, no sufficient assurance of high quality. In fact, the percentage of scrap wheel in a mixture is no safe criterion of the quality of the product, or of the extent of the crime ascribed to wheel founders in justly appreciating the convenience and economy of a metal more uniform than most pig iron. Its kind of variations, moreover, can be better estimated by fracture.

On the other hand, Charles V. Slocum, commenting on Mr. Fawcett's views (*The Iron Age*, Jan. 16, 1902), says: "I will defy any one to make an absolutely satisfactory cast-iron wheel without at least a portion of old wheels." This promised defiance and its basis is, however, too late for discussion, as the matter is a question of fact. For against such merely negative statement I have to say that while even with the aid of some chemistry the attempt by others may have failed, yet during a period when the old wheel was relatively high in price I used almost none for some time, and finally, in order to prove the efficiency of my methods, I made a heat without a particle of wheel or hard scrap or cupola return of any description and without charcoal iron or steel. The wheels were well chilled and absolutely satisfactory, and the analysis of a test piece was normal. Under similar conditions of the market, this experience can be repeated as far as convenient.

It is because of the present status of the chilled wheel, in spite of margins of variations wholly unendurable in the range of steel, that I can heartily indorse Mr. Slocum's belief in its future.

As hinted above, the wheel maker must begin to study the structures of his product by means of metallography, just as many steel men are now doing with great advantage to their product. The steel men were first in applying chemistry, and are therefore first in metallography, a science which explains many mysteries of chemistry.

Few founders realize the fact that it is now possible to see, with greater distinctness than can be reproduced here, great detail of structure in any metal. In the case of cast-irons or steels, 10 to 20 minutes usually suffices to prepare a sample for examination. Its photomicrograph can then be conveniently made.

*Reprinted from *The Iron Age*.

A New Air and Gas Compressor.

In designing the compressor illustrated herewith the chief object was to make a discharge valve that would be automatic in operation, open and close quickly at any part of the stroke and permit of ample discharge area, for high piston speeds, with minimum clearance loss. By means of the wrist plate and mechanism this same valve performs the function of an intake valve as well, the same valve opening being used for admission and discharge, thus further reducing clearance loss and providing maximum cooling surface in the water jacket of cylinder heads.

The inventor worked on the idea that since the line pressure of all air compressor plants varies continually on account of the variation in work done by the different motors using the air, the discharge of air from the compressor takes place at a correspondingly varying point of the stroke, and unless the discharge valve mechanism is properly designed power is lost by early or late opening of the valves; also that up to the present time no valve other than the poppet discharge valve has met these peculiar requirements in a satisfactory manner. In support of this it is said that nearly all compressors of standard types are fitted with poppet discharge valves, while the intake valves are of innumerable designs, automatic or positively operated; and that while the poppet discharge valve adjusts itself perfectly to variation in load, the available space in the cylinder when using this type of valve is not sufficient to insure ample discharge area for high piston speeds without perceptibly increasing the pressure at the point of discharge, causing a loss power; its construction also preventing proper water jacketing which tends to diminish the efficiency of compression.

Fig. 1.

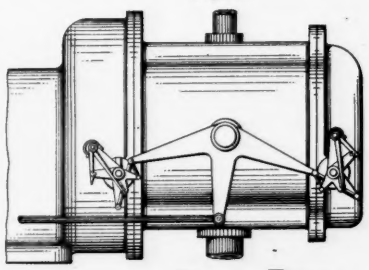
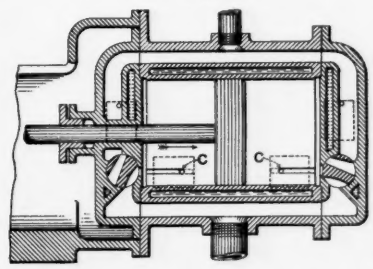


Fig. 3.



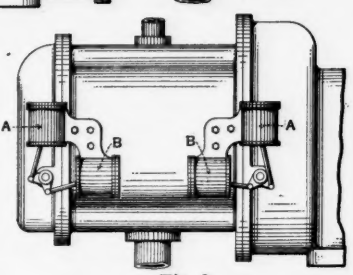


Fig. 2.

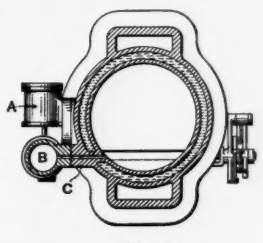


Fig. 4.

The Weber Air and Gas Compressor.

The operation of the new device is as follows: At the beginning of the compression stroke the valve is positively closed by means of the wrist plate, and remains closed until the cylinder pressure slightly exceeds the receiver pressure, when it is opened wide by this slight excess of air pressure. The valve remains open to discharge until the piston has traveled to the end of its stroke or expelled all of the air from the cylinder. At this point the difference in pressure, between receiver and atmosphere, acting on the two smaller cylinders, A and B, closes the valve to discharge and rotates it further to its intake position, where it remains until the end of the intake stroke. It is then again quickly closed by means of the wrist plate before compression begins. Figures 1 to 4 inclusive show various elevations, sections and details.

A communicates with the air receiver and B with the inside of the compression cylinder by means of opening C. During the intake stroke the plunger pistons of A and B are in the positions shown at the right in Fig. 2; receiver pressure in A and atmospheric or intercooler pressure in B. The valve is shown open, at the left side in Fig. 3, for corresponding position.

At the beginning of compression stroke the plunger pistons of A and B are moved just enough to close the valve; as in the corresponding position of valve on the right side of Fig. 3. As soon as the pressure in the compression cylinder, communicating through C to small cylinder B, slightly exceeds the receiver pressure it acts on the piston of B so that pistons of A and B balance each other, as shown on left side of Fig. 2. This instantly opens the valve to discharge, and it remains wide open until the piston has passed completely over opening C. At this instant the air in the small cylinder B expands to atmospheric pressure, back through opening C, causing the plunger A to drive back the plunger of B very rapidly and noiselessly. B acts as a dash pot. The valve now remains open for the entire intake stroke and is again closed positively at the beginning of the next stroke.

This valve, and its adaptation to the compressor, is the invention of Mr. F. C. Weber, resident sales agent of the Rand Drill Co., 710 Park building, Pittsburgh, Pa.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY
At 32 Park Place, New York.

EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

Boston newspapers have already come out with articles bearing big, black headlines, warning the merchants and manufacturers of New England that after July 1 they may expect to be asked to pay for the use of freight cars if they use the cars as storehouses. The reporters base their statements on what they have learned from "railroad men." They do not say who the railroad men are, but it is evident that those of the New Haven or the Boston & Maine, or of both, have already given their customers the alarm. This is highly encouraging. If, as Western railroad men assert, the New England roads have been giving consignees of carload freight far too much free time, it is only just that notice should now be given, and, after a reasonable interval, the excessive allowance be stopped. This is demanded by simple business equity, regardless of what a New England road pays a Western road for cars. The fact that Connecticut and Rhode Island compel the allowance of 96 hours' free time to each consignee is prima facie evidence that the average allowance is too much. Moreover, a good deal of the freight which detains Western cars, and exhausts the patience of Western railroad officers, is cotton, which is not bulk freight at all. Half of 96 hours is enough, as a rule, and 48 hours is the prevailing limit nearly everywhere, outside of New England. The railroads of New England ought to make a persistent appeal to the Legislatures to abolish or amend these laws. If they continue to meekly submit, the lawmakers will soon be requiring the allowance of a week on every car.

As long as these 96-hour laws are on the statute books, the New England roads can very reasonably ask their Western connections for a special allowance on that account. We are not saying that the Western lines should not at the same time put in their claim, if they have one, that the New England roads receive too large a share of the joint revenue on through shipments; the point is that car-hire, which is a part of the cost, should be computed equitably, at the outset, whatever contention there may be afterward concerning revenue. It is to be borne in mind that problems of this kind will not be found in New England alone. There are other localities where consignees have been favored too liberally, and the time is now at hand when justice should be dealt out to them—though, like the guilty Irishman, before the court, they will probably not want a great deal of it. The New England roads need not fear that they will have to settle this difficulty wholly by themselves; the trunk lines will doubtless have to study it very thoroughly in connection with some of their own terminals. If the enforcement of adequate car service charges results in closing cotton mills in Massachusetts, it is likely to produce similar effects in certain other States. If, as the New Haven road seems to intimate, the exaction of a fair charge for transportation and terminal services is really going to threaten the life or prosperity of important industries, the situation is a serious one; but even so, on what grounds of equity can the Western railroads be asked to continue to bear an undue share of the burden? The officers of those roads are bound to seek to establish reasonable car service rates, simply on the basis of justice to their own stockholders. As far as the larger roads are concerned, they seem to have already tempered their demand for justice very materially, in agreeing to the rate of 20 cents per car per day. In the busy season this is absurdly low.

President E. P. Ripley is quoted as saying that his road (the Atchison, Topeka & Santa Fe) probably will not comply with the recent ruling of the Interstate Commerce Commission declaring illegal the practice of the Santa Fe and Southern Pacific of taking into their own hands the matter of selecting the route by which fruit shipments from Southern California to the East shall be sent. He says: "I don't think the ruling is equitable. The railroads make a rate of $1.25 a hundred on citrus fruit to Chicago and the same rate to New York. In order to make this rate we must have satisfactory arrangements with our connections East. Before the railroads adopted the system of routing shipments, the business was in a constant state of demoralization. Shippers were in the habit of sending their fruit over any road whose overzealous agents would give them a few dollars rebate on each car, and if we don't control the routing we must either cut rates to meet this sort of competition or give up handling the business." But how about the law requiring publicity of tariffs and three days' notice of a change in rates? It is almost universally agreed that this law is, in principle, sound; but is not an unannounced change of routes precisely equivalent to an advance, without notice, in the rate over the route which you thus forbid the shipper to use? Quite likely this whole question is one of methods of procedure, rather than one of substantial injustice, but it calls for settlement, all the same, for it opens up evasions of the letter of the law, howsoever we may reason about business equity and the spirit of the law. As we understand it, the railroads assert that the custom of changing the route from day to day, and even after the goods have made a part of their journey, is an advantage to the shipper; facilities in the matter of speed, convenient delivery, the return of empty cars, and making desired changes in destinations can be more easily furnished. If this is so why should not the initial road issue a tariff stating the conditions, and formally assert its right under the bill-of-lading offered, to change the route? If the right to change is of value to the railroads they can afford to make the shipper an allowance for it; and if it is of value to him he can afford to accept an allowance which is reasonable to both sides. If it is one of he Atchison's own friendly connections that employs agents who are overzealous in giving secret rebates, why should not the Atchison permanently divert all through-rate shipments from such a connection?

Semaphores and Disks.

A valued correspondent, whose letter appears on another page, has got the idea that the enclosed disk signal has been snubbed by the *Railroad Gazette*, and he has broken out with a call for information as to who backs us up in an innocent statement which appears in our discussion of the Fourth Avenue tunnel. We assumed that we had the endorsement of the highest authorities; but who are the highest authorities?

Well, as semaphores are used by all important railroads from Maine to California—to say nothing of their use on almost every mile of railroad in England, as also all over the Continent of Europe; and as most of these prominent railroads have tried other shapes of signals; and as the managers of these roads have the advice of civil engineers of education and experience, we think that we may fairly say that the managers and engineers of any one or all of the principal railroads of the country are our authority.

These numerous judges decided in favor of the semaphore 10 to 30 years ago when they began to use fixed signals. A number of them have confirmed that judgment within the last five years by adopting the electric semaphore in the place of the disk for automatic signaling. They used the disk as long as they felt compelled to do so, but made it take a secondary place as soon as they felt that they could do so safely and economically.

Moreover, we do not understand that the officers of the roads named by our correspondent, as using disks, differ with us on this question. All of those roads use semaphores also. Other things being equal, they seem to still prefer the semaphore.

"O. H. D." asks for the scientific and practical evidence of the superiority of the semaphore. For practical evidence, we may say, and he will agree, that of two objects, the same distance from the observer, alike in every other feature, that one which is long and comparatively narrow is more quickly and easily discernible than that which is circular or square. If an object is of changeable shape (or position), as a semaphore is, it is with this shape that a change can be most quickly and strikingly made. A decided change in shape more quickly arrests the attention than a change in color, or than a contrast between dark and light, as with disk signals. This practical evidence is also the scientific evidence. That is why the scientific men, to whom we refer, have approved the semaphore.

Although we spoke in very brief and general terms, we think we may fairly ask our critic to observe that we were dealing with a particular kind of disk, in a particular place. He bases his criticism on another disk, used in situations quite different. He bases his arguments on a disk signal which has a large artificial background; and on a signal in which the extremely light weight of the moving parts is an important advantage. In the tunnel which we were considering there is not room for a satisfactory artificial background, and in the conditions that we were considering there is no special advantage in light weight. Moreover, we did not assert, without qualification, that a disk was not a suitable signal in that situation; we merely spoke of the fact that the semaphore was not used. The question of the difficulty, whether small or great, of devising a semaphore suitable for that situation, was left untouched.

When we get on common ground, our correspondent and ourselves are very well agreed, as he will admit if he recalls what we have said on this subject in past years. One or two observations are suggested, however, by the points which he makes.

Taking, in their order, his three heads, reliability, visibility and cost, it will be noted, first, that in criticising the automatic semaphore he ignores the electro-pneumatic; or, rather, he does not make any claim that the semaphores in that system can be dangerously loaded with ice. As that system is, perhaps, more costly than others, we may, for the purpose of this argument, let this point pass; but it cannot be fairly ignored. Again, in considering the objections to signals that may be obscured by snow on the glass or in which sunlight on the glass may dazzle a runner, he says nothing about the difficulty of enforcing discipline when using signals which may for hours or days at a time bring into play the rule about treating an imperfect signal as a danger signal. It is difficult to make enginemen fully respect this rule, and this difficulty is one that makes superintendents very critical of any signal which seems likely to depend on it. We do not say that this critical attitude is fully justified, for we are ready to advocate even unorthodox measures if thereby we can compel superintendents to improve their discipline; but "O. H. D." must be ready to deal with this feature of his case.

But after admitting all of our correspondent's good points, we are still at a loss to understand why he has taken the present incident as a text for his essay. He is defending all the other features of the enclosed disk signal *except* its shape, and shape is the main feature in which it is to be compared with the semaphore. While still adhering to all these points, why not meet the final point of the semaphore theorist by changing the shape of the disk from round to oblong? The semaphore *principle* does not depend on a blade four feet long; nor on the signal arm being exposed to the weather; nor on its being pivoted at one end. As "O. H. D." well shows, a signal need not be visible a long way off; for short distances a small arm is better than a long one; and a short arm would go inside an automatic signal "banjo."

Take the case of the tunnel which started this discussion. The signal must be narrow enough to stand between a wall which is close to the track and the side of a passing car. At some hours of the day some of the signals are clearly visible by daylight, so that the light from the lamp is less conspicuous than the outline of the lamp case (which constitutes the disk). In that case the stop or caution signal is the same shape as the go-ahead signal, the change being in the color of the lamp case. To make such a signal effective, the cases must be frequently painted. It seems quite possible that, even with the necessary limitations of space, the semaphore principle—a signal which changes its shape—might be

made to give more satisfactory service than a signal depending on color.

In the matter of economy—cheapness of installation and maintenance—our correspondent has left off just where he ought to have begun. He has neglected his main point. If he had only signed his real name we are sure that our readers would have gladly accepted his statement concerning superior economy. But whether with or without a name, some actual figures from one year's or five years' records would be read with great interest by everybody.

An Analysis of an Old Rail.

Mr. Thomas Andrews has for years been known as a studious investigator of steel rails. In a recent number of *The Engineer* (April 18) he gives a report of a physical, chemical and microscopic study of a rail taken out of the main line of a British railroad. This was a Bessemer rail which had been in service for 15 years. It weighed originally 82 lbs. per yard; the worn rail had been reduced by wear and corrosion to about 64¾ lbs. per yard. It had lost 1.15 lbs. per yard each year of its life.

The chemical analysis appears to have been very careful. A section at the end of the rail was analyzed, analysis being made of the head, the foot and near the junction of the head with the web. The same three sets of analyses were made at 12 ft. from the end of the rail. All of these showed considerable differences, indicating local segregation. The carbon ran from 0.33 up to 0.36, being highest in the neck; the silicon varied from 0.098 to 0.118; the manganese ran from 0.396 up to 0.468; the sulphur ran from 0.185 to 0.220, and the phosphorus ran from 0.118 to 0.136. Here again the highest determination was found at the junction of the head and the web.

The wear of the top of the rail had nearly cut into the local segregated area, and Mr. Andrews thinks that the rail would have broken soon, for this reason. This he considers a fruitful source of danger in old rails, and he calls attention to it repeatedly in the course of his paper. Not only are the sulphur and phosphorus highest in this region, just at the lowest part of the head, but the high-power microscopic examination showed there "innumerable internal micro-flaws which had reduced the strength of the rail to an unknown extent." The existence of impurities is regarded as the chief cause of this condition.

While the silicon was high the manganese was low, as was the combined carbon, and the carbon and the silicon had segregated locally at the neck. The sulphur was more than double what should be found in a good rail, as was the phosphorus. It is thought that the rail lasted as long as it did only because of the "comparatively low proportion of the carbon and the manganese."

In the physical tests the elongation was 8 per cent. in the specimen taken from the head of the rail and 9.5 per cent. from the bottom of the rail, the distance between gage points being two inches. The reduction of area was 11.6 per cent. The sample from the head of the rail broke in the tensile test at 34.44 tons, and the sample from the bottom of the rail at 34.52 tons; or at 77,146 and 77,325 lbs. respectively.

Mr. Andrews concludes, and probably with justice, that the presence of the micro-flaws just below the present wearing surface of the rail formed a very dangerous element, which would undoubtedly have soon led to fracture had it not been taken out of service.

March Accidents.

We publish in another column of this issue a condensed record of the principal train accidents which occurred in the United States in the month of March. The record contains accounts of 28 collisions, 26 derailments, and five other accidents. Those which were most serious, or are of special interest by reason of their causes or attending circumstances, occurred as follows:

7th—Maxon, Tex. 16th—Minidoka, Idaho.
14th—Knox, Ind. 23d—Covesville, Va.

It will be observed that this list is unusually short, the derailment at Maxon being the only passenger-train disaster of a magnitude to be compared with the worst accidents of the preceding six months. There were many train accidents on and near the first day of the month, which were caused by the extensive floods occurring at that time, and four of these accidents appear in the record.

There was a collision at Crookston, Minn., on the 13th, which was not of enough account to be put in the record, but which is of interest by reason of one of the contributing causes. A freight train ran into a switching engine on the main track at the station, and both engines were tipped into the ditch; and the reason why the switching engine did not get out of the way, was, according to the reports, the absence of a headlight on the engine of the freight. The headlight had been broken, some little time before, and a lantern was used in its place. It will be remembered that a collision similar to this occurred in the same region a few months ago, and an engineman was killed. The Standard-Code rule for switching engines, working at night, requires the display of two lanterns at the rear when there is no headlight shining in that direction; this would seem to be an excellent rule for road engines, as well as switchers, and for the front end as well as the rear. Moreover, a little experimenting would probably show that three or four lanterns, fixed in a horizontal line, would be better than two. At all events, if it is proper for enginemen to judge of the distance between themselves and an approaching train by the appearance of the rays from the headlight, and if this practice is common, the rule ought to provide for the use of the most efficient possible substitute for the headlight, whenever any emergency arises demanding a substitute. If the headlight is ordinarily thus depended upon, and if when it fails no adequate substitute is available, a reduction of speed is the only safe alternative.

A press despatch from Indianapolis, Indiana, March 22, contains a thrilling story of how a disastrous wreck had been narrowly averted near Washington, in that State, by the promptness of a train despatcher in sending a yard engine, at breakneck speed, after a freight train which he had by mistake allowed to depart when the road was not clear for it; when, if the train proceeded according to its orders, it would collide with an express train coming in the opposite direction. The story ends up in the regulation fashion, the engine overtaking the freight train after an exciting chase of ten miles. The track was cleared for the opposing train, and the switch set straight, exactly 59¾ seconds before the express came along; and it was running, of course, at 75 miles an hour. We have not taken the trouble to inquire as to the truth of this story, because the truth so often spoils the story; but we mention it here to warn other railroads against similar occurrences in the future; for since the Indianapolis story was published—and it was copied everywhere—accounts of the same kind have appeared from half a dozen sources, and it is plain that not only is the disease likely to become epidemic, but in this case actually was so, to an appreciable extent. Whether it is an epidemic which really affects train despatchers, or is to be found only among reporters, we are unable to say.

The number of electric car accidents which we find reported in the newspapers for March is 14; in which four persons were killed and 109 injured. Two of these accidents were butting collisions on interurban roads, where the conditions appear to have been similar to those under which butting collisions frequently occur on standard railroads. In these two collisions three persons were killed. Of the large number of passengers injured, about two-thirds (70) were hurt in a single accident, at Madison avenue and 44th street, New York city. A car ran against a pipe extending out from a builders' steam engine, standing near the track, and the pipe was broken; nearly all of the passengers in the car were scalded.

The sale of the Western Maryland is at last accomplished. In spite of technical denials it is probably safe to say that the purchase is made in the interest of the Wabash. This means a definite intention on the part of the Gould interests to establish an independent line to the Atlantic seaboard, the first serious project of the kind since the completion of the Lehigh Valley to Buffalo, ten years ago. It is an enormous task, however, and will take much time and money. The new owners are still a long way from Pittsburgh. They probably have a strong interest in the West Virginia Central & Pittsburgh; but still there is a gap of 250 to 300 miles to be filled from Cherry Run, the western terminus of the Western Maryland, to Pittsburgh, and much of the country is extremely heavy. All around within 25 miles of Pittsburgh the valleys are occupied by railroads already, so that a location will be difficult and costly. If this connection can be made for twenty-five millions the projectors may be considered fortunate; and to this must be added many millions for putting the Western Maryland in condition for heavy traffic. Moreover, they will undoubtedly find it necessary to control the West Virginia Central & Pittsburgh, which will take perhaps seventeen millions more. However, the Pittsburgh district is a great mine of wealth. In 25 years it will furnish more railroad traffic even than the "Black Country" of England; so that no new railroad can destroy, or greatly impair, the value of those now there. The total length of the Western Maryland lines is 253 miles, which includes branches to Shippensburg, York and other places; all of them leased lines. The main line, from Baltimore to Cherry Run, is 106 miles long. The road has 61 locomotives, 78 passenger train cars and 712 freight cars. The total outstanding stock amounts to $1,008,950, and the funded debt to $4,431,697; but there is about four millions of accumulated interest due to the city of Baltimore, and the amount now to be paid to that city apparently covers nearly the whole of the stock, bonds and debt of the company, though, according to Poor's Manual, the preferred stock ($324,000) and $110,000 of the common stock are owned by Washington County, Maryland.

NEW PUBLICATIONS.

First Aid in Accidents. By Charles R. Dickson, M.D. Chicago, New York and Toronto: Fleming H. Revell Co.

This is a little manual of 125 pages, 3¾ in. x 6¾ in., which has been prepared for the International Association of Railway Surgeons, Dr. Dickson being the Secretary of the Committee on First Aid of that Association; and according to a statement on the title page the manual was indorsed by the association at its last annual meeting. The work is divided into five chapters, each chapter furnishing the material for one lecture. The subjects are (1) anatomy and physiology; (2) cleanliness, hemorrhage; (3) injuries; (4) insensibility; (5) carrying the disabled, and preparations to receive them. The book is illustrated with drawings, showing how to make and apply bandages, how to tie knots, how to stop bleeding by pressure with the fingers, how to carry an injured person upstairs or into a car, and many other processes which could not be intelligently explained without pictures. The illustrations of knots might be made clearer.

From the layman's point of view this is a most excellent manual. It is in clear and simple language and systematically arranged; is terse and direct, wasting no words, yet full and clear on every necessary subject. And one feels pretty confident that the author's professional brethren will give the same verdict, for in addition to the virtues mentioned, there is evidence on nearly every page that the writer is speaking out of a wide experience. The suggestions as to improvising splints, tourniquets, poison-antidotes, cushions, stretchers and other appliances, when one is dependent wholly on his own ingenuity are full and clear, evidencing a large fund of common-sense. The preface says that the book is designed as a guide for instruction; that is, for lecturers; but it should have a value beyond that. It would be useful in the hands of any train, station, shop or yard man who would take enough interest in the subject to read the book through once or twice. Much of the information is fully available only after a demonstration by a competent person, but to a man who has attended lectures the book would be invaluable as a means of reviewing and clinching the knowledge acquired at the lectures. The book is small enough and thin enough to be conveniently carried in the pocket. It has a good index; but if put into the hands of employees it ought to have a glossary; for though the few necessary technical terms that are used are clearly explained, the explanation is not always to be found on the page where you are reading.

TRADE CATALOGUES.

Heavy Valves and Fittings.—A catalogue recently issued by the Crane Company of Chicago, deals with extra heavy valves and fittings for use under 250 lbs. working pressure. The quality of the material used in the construction of these valves is said to be, for hard brass about 34,000 lbs. per sq. in. tensile strength; for malleable iron, between 33,000 lbs. and 40,000 lbs.; and for gray iron, from 22,000 lbs. to 26,000 lbs. per sq. in. The catalogue contains cuts and sectional views of various sizes of extra heavy straight-way valves and extra heavy straight-way valves with by-pass. In each case dimensions and prices are given. Globe valves, angle valves and cross valves, of extra heavy make, with and without the by-pass feature, are shown together with sizes and prices. Relief valves, foot valves, blowoff valves, expansion joints and standard and indicator for operating large gate valves are presented. The concluding pages are taken up with illustrations and sizes of heavy cast-iron and malleable fittings, etc., for use with the heavy valves with which the catalogue deals. A copy will be sent to any one interested, upon application.

The Taylor Signal Co., of Buffalo, N. Y., has issued a handsome book of 160 pages, entitled Catalogue No. 1, describing its electric interlocking switch and signal apparatus. There is a preface of about 10 pages, a general description of the interlocking machine and signal connections of about the same length, and following this about 125 pages of detailed descriptions and drawings, with numbered lists by which goods can be ordered. Drawings are given of numerous yards and junctions which have been signalled by the company, and full page photographic illustrations of machines and signals. Taylor interlocking machines of less than 12 levers are so compact that a machine is supported on a single cylindrical pillar; and the wires to the machine from beneath the floor are run up through the hollow interior of the pillar.

The preface consists mainly of a brief essay on interlocking, comparing the four principal kinds: the common mechanical interlocking machine, the electro-pneumatic, the all-air and the all-electric. The deficiencies of all kinds except the electric are set forth in vigorous language. The Taylor electric apparatus was first put in use by Mr. John D. Taylor, on the Baltimore & Ohio South Western, in 1891. The present company took hold in May, 1900, and has installed the apparatus on many different roads. These machines are used with economy at places where as few as six levers are required. It is stated that the cost of producing the power is seldom more than one per cent. of the cost of producing any other kind of power for switches and signals. This comparison apparently deals only with running expenses and cost of material; no account being taken of deterioration of accumulators. At a large plant in Chicago, where 600 trains a day are handled, the gasoline for the motor charging the storage batteries costs only about one cent for each 326 movements. The Baltimore & Ohio South Western has found the Taylor apparatus far cheaper to maintain than an ordinary mechanical interlocking plant. Where tracks have to be moved or raised, the changes can be made with the electric system very much cheaper than with the mechanical. The "indication" which insures the complete movement of a

switch is claimed to be the best in use; and a cross or a ground cannot result in giving a false clear indication.

The preface gives the following interesting historical notes on interlocking:

1859 First on London & N. W.
1873 London & N. W. has 13,000 levers.
1874 First in United States.
1902 L. & N. W. has 36,000 levers.
1902 Total in United States, 40,000 levers.

It is estimated that half of the 40,000 levers in the United States are at grade crossings, whereas hardly any of those in England are at crossings.

The catalogue has for a frontispiece a perspective sketch of the new shops of the Taylor Company, at Elmwood avenue, Buffalo.

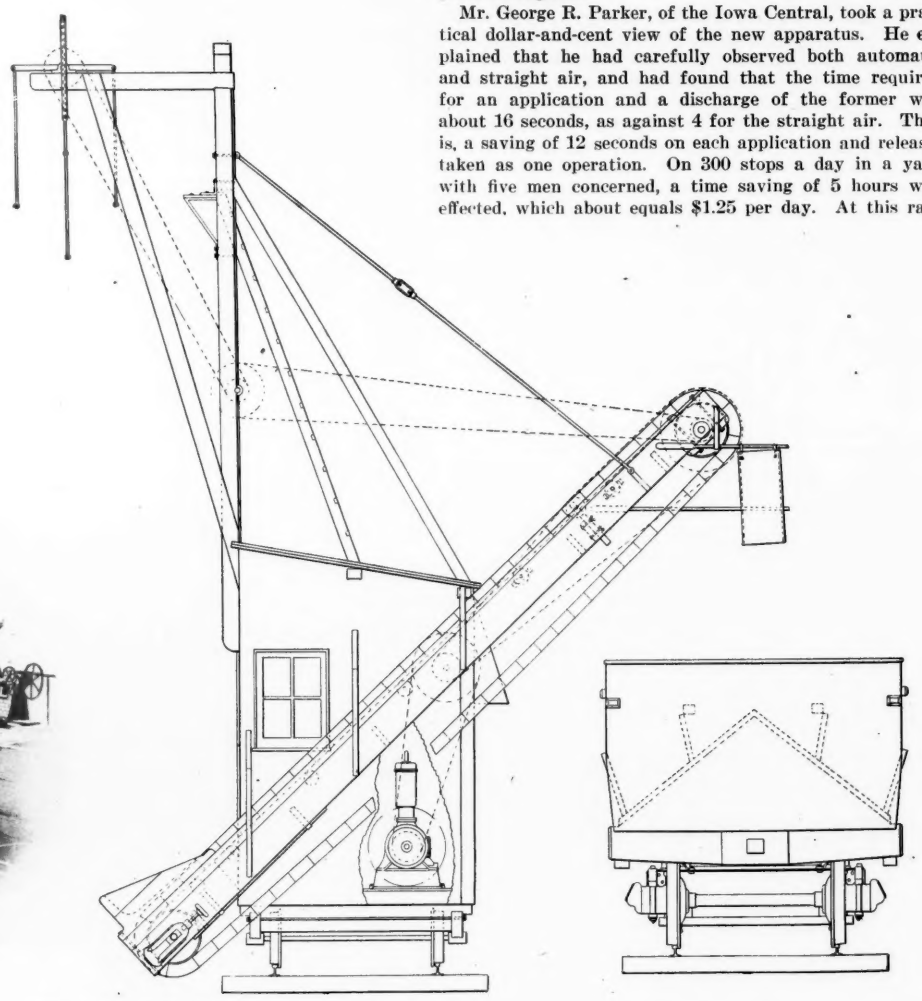
The Torry Ballast Loader.

A ballast loading machine, for the economical loading, by power, of material required for ballast renewals, has recently been put on the market by Fairbanks, Morse & Co., Chicago. The machine was invented by Mr. A. Torry, Chief Engineer of the Michigan Central. An account of its design and first trial on the Saginaw Division of that road, was published in the *Railroad Gazette* Oct. 13, 1899, p. 706. It is now used not only on the Michigan Central, but on the Duluth, South Shore & Atlantic, and the Mississippi River & Bonne Terre Railroads. The half-tone engraving shows the ballast loader as it appears in actual operation, and the drawing shows an elevation of the loading car on which the machinery is placed, and the ballast car situated on an adjacent track.

The loading car, when in position, occupies a track at the foot of the gravel bank, and has two inclined conveyors or elevators which receive ballast, and dump it into the ballast car. At the lower end of each conveyor there is a suitable hopper extending toward the gravel bank, and at the upper end, a pivoted chute is arranged so as to discharge the material in either direction parallel with the ballast car. A suitable framework is provided for the engines and machinery on the car, the lower part of which enclosed and roofed over protect the engine and the operator. The elevator buckets are made of steel plates in the usual way, forming practically a continuous carrier. The power is supplied by a 5 h.p. gasoline engine, and a suitable clutch on the countershaft is so arranged that the conveyor mechanism can be thrown out of gear and stopped without shutting down the engine. This clutch can be worked, if desired, by cords from a convenient point outside the loading car. The car is also provided with suitable gears, so that the engine can be used to move it along the track. The power of the engine is also ingeniously used to assist the workmen in filling the hoppers. Extending vertically above the operator's house there is an overhanging frame, supporting a shaft, on each end of which is a double crank, more accurately described as a pair of oppositely-extending crank arms; from each of these cranks a rope is suspended, at the lower end of which is attached a large scoop shovel. The rope is attached to the scoop near the blade, with a strap and buckle to make it adjustable. These scoops are about three times as large as the ordinary track shovel. The crank shaft is about 24 ft. above the rail, overhanging the inner rail about 7 ft., and having cranks about 18 in. long, it will be seen that the men using these shovels can cut the bank away, on a level with the under side of the ties, to a distance of 10 ft. or more from the hoppers.

The material is dug and deposited in the hoppers by the men with the scoop shovels. Each man handles his shovel much in the usual way, but he has the assistance of power derived from the motor, which imparts a constant rising and falling motion as the cranks overhead, revolve. In working these shovels each man times his movements with the up and down motion of the shovel. When the shovel is in its lowest position, the operator presses it into the bank and continues this pressure during the early part of upward movement. When the shovel has been carried to its highest position, the operator swings it above the hopper and overturns it. He then returns the scoop to the bank during the downward movement. Thus the filling of the shovel is largely, and the lifting of the loaded shovel is entirely, done by the power supplied, and the manual participation in the work is required when the vertical movement is least.

The men can easily keep time, with the shaft making about ten revolutions a minute, one scoop at each end being up when the other scoops are down. Each man will deposit ten large shovelfuls into the hoppers per minute, there being four men at this work. The ordinary rate at which a man will load gravel onto a flat car from the ground level is about 11 shovelfuls a minute of ordinary track shovel size. The scoop shovels used with this machine being about three times the size of the ordinary track shovel, and the speed in loading nearly the same, it follows that each man will do about as much as three men working in the ordinary way. As the physical exertion of each man is very considerably reduced by the automatic raising and lowering of the shovels, very much steadier and continuous work may be expected. Four men, with the assistance of two men to pole down the bank, can thus load 12 cars, holding each 26 yds. of gravel, per day, of ten hours. The hauling of this gravel can be ordinarily accomplished by making use of local freight trains. This arrangement permits of handling small quantities of material at a cost closely approximating to that of steam shovel work.



The Torry Ballast Loader.

Straight Air for Engine and Tender Brake.*

The consensus of opinion among those present at the North-West Railway Club meeting, when Mr. F. B. Farmer read his paper on The Combined Straight Air and Automatic Engine and Tender Brake, was that although the Westinghouse Air Brake Co. had gone back, in this device, to a principle it once discarded, yet it was not a retrograde step, but one of progress, resulting naturally from the development of the automatic brake as applied to long trains.

Mr. James Casey, of the Minneapolis, St. Paul & Sault Ste. Marie, spoke from actual experience of the device, as did several others. He said it was very useful in switching a long train of cars, where a kick-off had to be made. Just at the moment the engine is coming to rest the release is made to prevent the engine being anchored against the slack of the cars, and much less damage, all round, is the result.

That straight air on engine and tender obviates one or two serious difficulties experienced in handling long freight trains, was pointed out by Mr. J. E. Goodman, of the Northern Pacific. There is a tendency for trains to break in two, following the release of brakes at moderate speeds, and this tendency increases almost to a certainty at low speeds. The forward cars in the train release before those behind let go, thus destroying retardation at the front, but keeping it in operation behind, with very probably expensive results. If the rear brakes do come off satisfactorily on release, at low speeds, the result has no doubt been produced by leaving the engineer's brake valve in full release for so long a time that the pressure in the forward end of the train generally becomes higher than the feed valve is adjusted for, and when the brake valve is put in running position, the brakes of the forward cars are apt to creep on. All this the new device obviates by holding the cars bunched against the engine and keeping the speed of the entire train uniform until release is complete throughout.

Mr. George R. Parker, of the Iowa Central, took a practical dollar-and-cent view of the new apparatus. He explained that he had carefully observed both automatic and straight air, and had found that the time required for an application and a discharge of the former was about 16 seconds, as against 4 for the straight air. That is, a saving of 12 seconds on each application and release, taken as one operation. On 300 stops a day in a yard with five men concerned, a time saving of 5 hours was effected, which about equals $1.25 per day. At this rate 25 days' service would see the device pay for itself. After that its use would be clear gain.

Mr. Strickland, in a communication on the subject, also alluded to the saving qualities of straight air as applied to engine and tender, by showing that in trains with loads ahead, the empties at the rear have a tendency to stop before the loads do, and so throw a heavy strain on the draw-gear. He regarded the saving in this direction sufficient to justify the cost of applying the device, regardless of the saving it undoubtedly effects in the reduction in the number of flat wheels. So much for utility. In the matter of comfort the straight air application on express trains for water tank stops is positive, and much more agreeable to passengers.

As to cost of maintenance, one speaker pointed to the fact that paradoxical as it might appear, it was cheaper to maintain two valves in the cab than to repair one, by reason of the fact that the engineer's valve when constantly used for emergency stops soon blows all the lubricant off the face of the rotary valve and it consequently grinds and cuts. The repairs necessitated by this kind of treatment have to be made frequently and they require the employment of the highest grade of skilled labor.

As a safety appliance, if one may so say, a strong point was made in favor of straight air. When brakes are applied by this means, there is no such thing as leaking off. A fireman can crawl under the engine and clean out the ash pan with perfect safety. An engine can be left standing with straight air-brakes set, with almost absolute

*See *Railroad Gazette*, April 4, 1902, p. 245, for the paper on the subject.

security, as any tendency to leak off is overcome by continuous direct pressure from the main reservoir.

Mr. Farmer, in practically concluding the discussion, referred to the fact that, although straight air as now applied by the Westinghouse Air Brake Co. was certainly a good thing, it nevertheless needed intelligent handling. Good things when badly worked may give a net result very far from satisfactory.

British Lessons from the Westinghouse Building Methods.

Supplementary to the discussion of American commercial and industrial methods, as compared with those of England, an article, from the pen of Mr. D. N. Dunlop, appears in a late issue of the *Nottingham Guardian*. While it relates primarily to the construction of the Westinghouse Electric Works at Manchester, questions are involved which affect the entire industrial situation of Great Britain. The article reads, in part:

"The recent achievement of the British Westinghouse Company at Manchester has caused heartsearching in the building and electric trades. It is now a little more than two years since the Westinghouse Company decided to establish works for the manufacture of electrical apparatus in this country. The works are designed on a magnificent scale, but the most remarkable thing about them is the way in which the building has been accomplished. One hundred and thirty acres of ground are covered by the various buildings, and 10,000,000 bricks had to be laid. When the work was begun in the spring of 1901, it was estimated by British builders that the building operations alone, quite apart from the installation of machinery, would occupy several years.

"The Westinghouse Company engaged Mr. James C. Stewart, a contractor of St. Louis, Pittsburgh, and New Orleans, as building manager; and Mr. Stewart, with half a dozen young assistants from the other side of the water and 3,758 British workmen, achieved what every onlooker, prophet, or critic would have dismissed from serious consideration as an absolute impossibility. He established an average of 1,800 bricks per man in a nine-hour day, with a maximum of 2,500 bricks per day for the plainest work.

"Daily reports from all the foremen and sub-foremen were handed in to him, and men who were not up to the work were not kept on. During the third week of operations, the average had risen to 900 bricks per man per day, and by the continuous process of weeding out the idle and useless, the high standard of 1,800 bricks was gradually approached. The trades union did not allow the 'new methods' to proceed in silence, and once or twice it looked as if trouble might be in the air. In every case, however, matters were smoothed out without having recourse to unpleasant proceedings. Managers and delegates met amicably enough, and the officials of the company, with that strength of purpose and energy the want of which in the British employer of the last two generations has been so deplorable, made it perfectly clear that while they would pay their workmen not only the standard union wage, but an even higher wage than the union required—11d. (22 cents) an hour instead of 10d. (20 cents)—they meant to manage their own business and would not brook interference from outsiders. If these terms were not acceptable, means would be found of dispensing with the good offices of the union and its members. The result was peace with honor.

"A writer in the *Times* placed the recognized limit for dwelling houses, shops, and business premises built by a private contractor at 400 bricks per man per day; the limit in the case of public buildings he quoted much lower—330 bricks per nine-hour day. This computation was not allowed to pass unchallenged, but careful inquiries establish the fact that the number of bricks per man per day is considerably less than it was twelve to fifteen years ago, though rather greater than two or three years ago.

"Mr. Stewart obtained with British labor results that are absolutely unique in the records of British industry. The methods were characterized by a dash and energy unfortunately not now regarded as typical of this country. While the building was going on, a number of young British engineers in the employ of the company were sent to the machine shops at Pittsburgh for further training. A leading northern daily waves away with scorn the 'damaging and humiliating' inference that British engineers have any need to learn in the United States, and prefers to suppose that these men have been sent out in order to familiarize themselves with the 'peculiarities of American machine-shop practice,' and 'with methods and ideas which, if not better than our own, are different, and have to be studied on the spot.'"

English and American Locomotives.

The following extracts are from the *Madras Mail*, Jan. 13:

Some of the comparisons one sees made between the English and American locomotive are most extraordinary. If an English firm builds an engine to haul a load of 1,000 tons and an American firm builds an engine to haul a load of 2,000 tons it is ridiculous to compare the performances of the two types of engines. One hears and reads all sorts of general statements that an American locomotive burns more fuel, requires more oil, costs more for repairs, does its work more easily, runs faster, starts away more quickly, or does fifty other things more efficiently or less efficiently as the case may be than its English rival; but these criticisms seldom give or even suggest reasons for the alleged differences. It is perfectly clear that, given a locomotive with a fixed size of cylinder, and of wheels, with a fixed weight for adhesion and a fixed boiler pressure, it cannot matter—provided of course that the workmanship in each case is equal, and that the boiler is designed to suit the fuel to be used—whether the engine is built in America, England or any other country. An engine with identically the same leading dimensions ought to be able to do identically the same work.

American designs give very large boilers, and it is questionable whether the point of maximum economy in this respect as regards coal consumption has not been passed. Large boilers with ample grate area and heating surface may not always give the most economical results, but whether economical or not, there is no doubt that as far as efficiency in other directions is concerned it is much better to make locomotive boilers too large than too small, so that although the Americans with their very big boilers perhaps lose in one way they gain in another.

American locomotives are always fitted with cylinders outside the frames, the advantages of which are that besides getting rid of the crank axle, much greater latitude in arranging the wheel base and designing the engine generally is obtained. To see the effect of the latitude obtainable by using outside cylinders one has only to compare the eight-wheeled coupled inside cylinder type of mineral engines recently put on the road by the Caledonian and the Great Northern, with its short connecting rod and long rigid wheel base, with some of the American engines with a leading bogie or radial wheel and short rigid wheel base. The latter engine, as far as general design is concerned, the most prejudiced person will admit, is much to be preferred both as a machine and as being much less severe on the permanent way.

No one for a moment supposes that an American mechanic cannot turn out as good work as his English brother, and if the American locomotive is inferior to the English production the reason is that the American builders deliberately and of a set policy manufacture a machine which they consider is good enough for the work it is required to do. In locomotive engines, as in all other machinery, fancy finish looks nice and costs a great deal of money, but much of it has no effect on the practical working of the machine.

The following remarks by Lieutenant-Colonel W. V. Constable, late Deputy Consulting Engineer for Railways, Madras, and afterwards Manager of the Eastern Bengal Railway, which are the outcome of an extensive inquiry made by him recently into the working of American railroads, will be read with interest by railroad men:

As regards the question of the merits of the American compared with the English locomotive, no doubt the American engine burns more fuel and wears out sooner, and the former is unquestionably a dirty looking machine, but Americans do not design their engines for looks, nor do they expect them to last more than 15 years, by which time they are ready to put them on the scrap heap and adopt a different design and a more efficient article; and it must be remembered that coal is extremely cheap in America. My admiration for them is based on the work they perform, and their great hauling capacity makes up for any defects in their details. I am afraid we do not scrap weak and out-of-date engines often enough in India.

After all, the first duty of an engine is either to run fast or to pull a big load, and I would sooner have a dirty looking engine that would haul 3 500 tons than a beauty to look at that could only haul 600 to 700 tons as in England, or 1,200 tons as in India. The cost of coal is only one factor in the cost of carrying a unit, and the E. I. Railway would be better if, with its cheap coal, its engines hauled American loads, even if its coal consumption per engine mile were doubled and its engines had to be scrapped at the end of 15 years. To say that Americans could not build just as nice looking an engine, or put just as good work into it as English manufacturers do is a statement I could not accept after having seen their tools and machinery and methods of work. As a matter of practice, American lines like to run an engine for all it is worth, provided traffic is offering, just allowing sufficient time for cleaning and repairs. Their dirty looking engines, moreover, keep remarkably good time.

If American engines were exclusively used on an English line sufficiently long to enable drivers and the staff generally to grow up with them, it would probably be found that an English engine would not be kindly received on that railroad. The converse, of course, would no doubt be equally true.

Railroad Betterments vs. Dividends.

In the management of every railroad company, there is a permanent diversity of opinion between those who want surplus earnings put into the property and those who want such earnings distributed in dividends. These issues have been especially important in the last eight years. Railroads have been almost rebuilt and re-equipped in that time. Reduction in rates resulting from competition made it necessary to increase net earnings by decreasing the ratio of expense and the issue came to a head at the point of net profits per train mile.

The steps taken have resulted in somewhat lower rates per ton per mile, but in a larger return per train mile, due to a better system of loading cars, resulting in heavier trainloads drawn by heavier locomotives, and, of necessity, supported by heavier rails and stronger bridges with fewer curves and easier grades.

It is within bounds to say that hundreds of millions of dollars have been employed in this work within eight years. No railroad could have held its own without large outlay and large achievements in these directions.

It will be said, of course, that the improvements of the past ought to have been made, but having been made, and to some extent at expense of dividends, they should now stop, giving shareholders their turn at the surplus. This argument might be sound if there could be a general agreement that all roads would stop betterments; but, unless such an agreement can be made, which is highly improbable, decided improvements in one line will have to be followed more or less fully by competing lines, if they expect to hold their business.

Another point should not be overlooked. While money expended in dividends is thrown away as far as the operating department is concerned, money put into a property wisely is not thrown away as far as dividends are concerned. Experience has shown repeatedly that small dividends and large betterments have been quite as effective in advancing the price of a stock as when dividends have been larger. Nothing strengthens a stock more than margin of safety in dividend earnings, and nothing weakens a stock more than doubt in regard to the stability of dividends. Lake Shore, Northwest, St. Paul and Illinois Central are instances of stocks which have sold at high prices on small dividends, because it was known that surplus earnings were being invested in the road, and that the true value of the stock was being largely raised.

The price of bank stocks is almost uniformly determined by the profits instead of by the dividends, and bank stocks have not infrequently sold at very high prices before any dividends were declared, because of the known policy that all profits were to be carried to surplus account until the surplus approximated the amount of the capital. If there were such a thing as the book value of railroad stocks, the effect of wise betterments would become as apparent as it is in bank stocks.

Again, earnings which are put into betterments can be, to a considerable extent, treated as undivided surplus, and stockholders can feel that they will get this money sooner or later, either in the form of increased dividends, increased certainty of dividends in bad times, or in some special distribution of cash or stock which will make up to them the advantage temporarily surrendered.—*Wall Street Journal.*

TECHNICAL.

Manufacturing and Business.

S. D. Anderson, representing the Standard Railway Equipment Co., of St. Louis, and the Murphy car roofs, has opened an office at 122 Liberty street, New York.

The Consolidated Car-Heating Company has recently been awarded the contract for the electric heaters for the 100 new cars which the Metropolitan Street Railway of New York City is about to operate. These equipments are eight of the panel type of heaters per car.

Knecht friction sensitive drills, made by the Knecht Bros. Co., Cincinnati, Ohio, have recently been put in the following railroad shops: Pennsylvania, Altoona shops; Southern, Knoxville shops; Baltimore & Ohio, Mount Clare shops, Baltimore; Illinois Central, Burnside shops, Chicago.

The White Enamel Refrigerator Co., of St. Paul, Minn., and Chicago, Ill., report excellent business. Among the orders recently placed are: Southern Pacific, 200 cars; Chicago Great Western, 100; Canadian Pacific, 50; Louisville & Nashville, 50; Chicago, Burlington & Quincy, 5; Colorado Southern, 1.

The Lake Shore & Michigan Southern has awarded to the American Blower Co., of Detroit, the contract for heating apparatus for its new passenger car paint shop at Collinwood, Ohio. The American Blower Co. has an order for apparatus for a three-compartment dry kiln for the plant of the American Car & Foundry Co. at St. Charles, Mo.

The Bettendorf Axle Co. announce that the recent fire will cause only temporary inconvenience, and full operation will be resumed by the 12th inst. with a possibility of getting under way again a few days earlier.

The Fairbanks Co. has moved its office to the corner of Broome and Elm streets, New York City, and combined under one roof the various branches in New York City.

An extensive business in the manufacture of cypress tanks is established at Palatka, Florida, by G. M. Davis & Son, who build tanks, etc., for railroads and many other users. They have the raw material right at hand and a thorough knowledge of the business, and the factory is supplied with the latest machinery. They have recently opened a branch office at 26 Cortlandt street, New York City.

The following railroad cars now under contract are being built under the inspection of the Pittsburgh Testing Laboratory, Limited:

For	No. cars.	At
Central R. R. of N. J.....	2,310	American Car & Foundry Co.
Phila. & Reading Ry. Co..	1,700	American Car & Foundry Co.
Phila. & Reading Ry. Co..	500	Cambria Steel Co.
Phila. & Reading Ry. Co..	200	Middletown Car Works.
Phila. & Reading Ry. Co..	200	M. H. Treadwell & Co.
Pittsburgh & Lake Erie..	1,000	American Car & Foundry Co.
Bessemer & Lake Erie....	1,000	Pressed Steel Car Co.
Great Northern	500	American Car & Foundry Co.
Great Northern	300	Cambria Steel Co.

The Westinghouse Electric & Manufacturing Co. has made an agreement with the Lorain Steel Company, whereby the Westinghouse Company acquires the electric railroad equipment business of the Lorain Company, formerly carried on under the name of the Steel Motor Company at Johnstown, Pa. The Westinghouse Company will maintain the works at Johnstown, and sell the steel motor as an adjunct to its own electric railroad business.

The increasing use in railroad shops of a mechanical

device for grinding drills in preference to the old hand method, is shown by the number of "New Yankee" drill grinders that were sold to the leading roads of the country during the past year. This list comprises 33 railroads, in various parts of the country, some of them having as many as four in use. The "New Yankee" claims some distinctive valuable features not found on other machines. It is made by the Wilmarth & Morman Co., Grand Rapids, Mich.

P. F. Brendlinger, whose office for several years past has been located at 409 Harrison Building, Philadelphia, Pa., has recently moved to more desirable quarters at 1009 Arcade Building. Mr. Brendlinger has been a railroad contractor for seven years, and at present has under way the construction of the new Gallitzin tunnel at Gallitzin, Pa., for the Pennsylvania Railroad, and the construction of three miles of four-track road at Lewistown Narrows for the same company. He has recently completed for the Philadelphia & Erie 10 miles of double-track from Renovo to Keating, Pa.

Johnson, Caswell & Stebbins, Baltimore Building, Chicago, is the style of a new firm, formed to conduct inspections and tests. Mr. Johnson has had a varied experience in electrical engineering, both in commercial and railroad work, in the latter connection having at one time been Chief Engineer of the National Switch & Signal Co. He later became Chief Electrical Engineer of the Easton Power Co., whose large plant he designed, and supervised its erection. Mr. Caswell has had 12 years experience in various lines of mechanical engineering, from draftsman up. He has been connected with several large manufacturing firms, and was also at one time in the Superintending Naval Constructor's office at Newport News ship yards, where he had charge of the turret work. Mr. Stebbins has had considerable experience in experimental and chemical engineering, mostly in the line of special work, and which will enable him to take charge of the laboratory work. It is the intention of the firm to make a specialty of the inspection of railroad equipment, and particularly of second-hand equipment.

Iron and Steel.

John S. Gibson, of Newark, N. J., has been appointed receiver for the Carteret Steel Co., whose furnace is located at Hackettstown.

According to report from Galveston, Texas, about 1,000,000 tons of steel rails have gone into Mexico through that city during the past three months.

The American Concrete Steel Co. has been incorporated in New Jersey, with $100,000 capital stock. John T. Simpson, J. Louis Hay and Geo. W. W. Porter, of Newark, are interested.

The Ohio Solid Steel Co. was incorporated in New Jersey April 30. The incorporators are Martin Baackes, Martin Bonnell, T. E. Young and 17 others. Address, 419 Market street, Camden, N. J.

A. E. Stilwell is reported to have placed large orders for rails in England and Canada, with which to lay the Mexican Division of his Kansas City, Mexico & Orient road. The last lot ordered were from Belgium.

The Monarch Iron & Steel Co., recently organized, has $100,000 capital. The officers are: President, S. M. Nease; Vice-President, Caleb Broomall; Secretary, E. M. Whippo; Treasurer, G. C. Broomall; Manager, J. R. Rose.

The Minnesota Steel & Machinery Co. has been incorporated with $500,000 capital. This is the new company which is to absorb the Twin City Iron Works, and the Minnesota Iron Works. The incorporators are James L. Record, Otis P. Briggs, Joseph Garbett, Ralph P. Gillette and Albert C. Cobb.

According to a statement given out by Rogers, Brown & Co., there will be within three months 15 new furnaces under construction in this country. When these are completed the pig iron output of the country will be increased by at least 5,000 tons a day. Seven of these furnaces are to be built by well-known existing companies, and eight by new companies, capital for which is provided without public financing.

Some changes in the officers of the Worcester plant of the American Steel & Wire Co. have been announced. In the Washburn & Moen plant, Charles Ranlet has resigned as General Manager and is succeeded by Harry G. Stoddard, who is at present Assistant Manager. J. O. E. Trotz, Superintendent of Quinsigamond Works, has resigned and is succeeded by Clinton S. Marshall, Assistant Superintendent. E. J. Watson succeeds Mr. Stoddard as Assistant Manager. George A. Cragin succeeds Mr. Stoddard as Assistant General Sales Agent. Thomas Horne succeeds Mr. Marshall; J. D. Crosby succeeds E. J. Watson.

It is noticeable that although the consumer is unable to secure deliveries of finished steel as promptly as desired, he benefits to a considerable extent by the conservative position of the leading manufacturers, who have not advanced quotations in proportion to the rise in the raw material. In the long run this will be an influence for good, preventing the curtailment of consumption that would follow any such inflation as occurred two years ago. It is almost impossible to discriminate as to any special line, practically all forms of finished steel being in greater demand than supply. Needs are very great in railroad and structural lines, the tonnage being unprecedented, and no cessation of activity is in sight. It is to be regretted that business still goes out of the country, more or less, and the slight concessions by foreign makers during the past week secured orders that otherwise would have remained unfilled. The large sale by the Erie Railroad of old rails at only a fraction below the list price of new rails indicates the condition of that product. Strikes in the building trades may check the consumption of structural material, although the numerous new edifices contemplated make it certain that mills will find a ready market for their output well into next year. Unusually heavy buying of merchant steel by implement manufacturers in March led to the belief that quiet conditions would prevail, but there is still no abatement of demand.—*Dun's Review.*

Post's Autograph Dating Stamp.

Mr. Thomas R. Post, of Wilmington, Cashier of the Atlantic Coast Line, has patented an automatic dating machine. Its principal advantage is a detachable signature die that can be removed and any other signature substituted in its place. By this arrangement in a business house where several are employed every man can carry in his pocket the die for his own signature and insert it into the machine in a second when he wants to use the machine. In this way every receipt that is given may be traced back to the man that gives it. The placing of dates is simplified and there is an automatic self-inking attachment, fresh ink being applied to the ribbon every time the machine is used. There is five-sixths less ribbon used than in other machines and the ribbon revolves constantly in one direction.—*Wilmington (N. C.) Messenger.*

The Sherwin-Williams Co.

The Sherwin-Williams Co., paint and varnish makers, will begin crushing seed and making linseed oil about June 15, having just completed a large plant for this purpose at Cleveland, Ohio. It will supply all the oil used by the company, and will also place the company in position to go into the general market with oil. For many years this company has been the largest consumer of linseed oil in America, and probably in the world. The new plant is on the Cuyahoga River, a short distance from plant No. 1 of the Sherwin-Williams Co., with shipping facilities by water and rail. It has been built with a view to expansion, the plat of ground and engine and boiler capacity making it possible to double the output within a few months if necessary. The company has its own steamship, the "A. G. Lindsay," for carrying the seed down the lakes from the Northwest, and will go direct to the farmer for the seed. The plant is under the direct management of Mr. J. W. Daniels, who has been in the business since 1878, and who, before his connection with the Sherwin-Williams Co., was a director in the American Linseed Co., and Manager of the plant at Buffalo, N. Y. For years the S.-W. Co. has made all its own varnishes and dry colors, tin cans, packing cases and barrels, done its own printing and made its machinery in its own machine shops. A few years ago it added a steam laundry, a barge for carrying lumber for its box factory, and greatly enlarged the facilities for making varnish and dry colors.

Westinghouse Electric & Mfg. Co.'s Improvements.

Work will be begun in a few weeks by the Westinghouse Electric & Mfg. Co. to double the capacity of its large works at East Pittsburgh, at a cost of about $1,500,000. The contract for the buildings has been let to James Stewart & Co., of St. Louis, and it is expected that these will be finished within a year. The American Bridge Co. has the contract for about 9,000 tons of steel for these buildings, which will be located between the present plant and Turtle Creek. The new shops will be about 1,700 ft. long and about 230 ft. wide, divided into three bays, a high central bay with two low ones.

Pressed Steel vs. Standard Steel Car Co.

The Pressed Steel Car Co. has entered an equity proceeding against John M. Hansen, formerly Chief Engineer of the Pressed Steel Car Co., and now President of the new Standard Steel Car Co., charging him with unlawfully securing 1,100 drawings, blue prints and bills of materials of cars and car parts, valued by the Pressed Steel Car Co. at $1,000,000.

Pressed Steel Car Co. and the Hegewisch Plant.

The injunction restraining the Pressed Steel Car Co. from acquiring a large interest in the Hegewisch car plant at Chicago has been dissolved in Jersey City by Vice-Chancellor Stevens. It was alleged that the directors of the Pressed Steel Car Co. proposed to pay an excessive price for the plant of the Illinois Car & Equipment Co. In denying the injunction Vice-Chancellor Stevens declared that no evidence that the directors had acted in an illegal manner had been presented. Whether it was a wise venture or not was for them to decide. It is reported that if the Hegewisch plant is taken over by the Pressed Steel Car Co. its capacity will be doubled.

Automatic Signals on the Lackawanna.

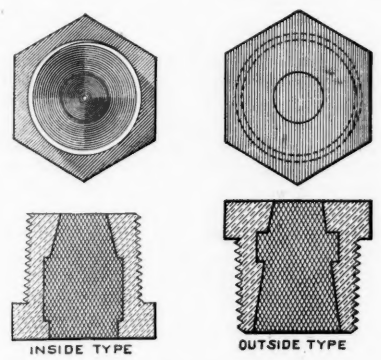
In addition to the gas-motor signals ordered by the Delaware, Lackawanna & Western, as noted in a recent issue, the company has ordered 125 automatic block signals from the Union Switch Signal Co. These are electric-motor signals, similar to those already in use on this road, a home and a distant arm on each post. The new signals will be used chiefly on the line between Clark's Summit and Hallstead, 42 miles. The gas-motor signals are to be put up on different sections of the road, in order to test them in as varied conditions as possible.

Western Steel Car & Foundry Co.

The Western Steel Car & Foundry Co., capital $1,250,000, was incorporated in New Jersey, May 6, to make cars and do a general foundry business. The incorporators are: J. A. Williamson, Davis D. Woodruff and William B. Denton, all of Jersey City.

Composition of Fusible Plugs.

The recent action of the United States Treasury Department in enforcing the provisions of Section 4,436 of the United States Revised Statutes regarding the specifications for the manufacture of fusible plugs, has directed attention to the composition of these boiler fittings. Fusible plugs have been used for a number of years, and the government recognizing the very important part they play as safety appliances, requires that all plugs used on boilers of steam vessels should be made of bronze and have no other filling but pure Banca tin. Many plugs have been offered on the market which are filled with fusible alloys composed of other metals, which, although melting at very near the same point as Banca tin, were



not absolutely reliable. Since the disaster at Philadelphia last fall, the United States Steamboat Inspection Service of the Treasury Department has taken cognizance of the fact that inferior plugs were on the market and has issued a circular requiring that all fusible plugs should be filled with pure Banca tin and stamped with the manufacturer's name, and that an affidavit setting forth this fact should be filed with the inspector having charge of the boiler inspection at whatever place the plugs are used.

The Lunkenheimer Company has manufactured fusible plugs for a number of years, all of which comply with these specifications, and, having made affidavit before the United States Steamboat Inspection Service to the effect that its plugs comply with these requirements, they are accepted by inspectors throughout the United States.

There are two forms of plugs shown; the use of either form is optional. One is intended to be screwed home from the inside of the boiler and the other may be put in from the outside. The taper section with shoulders which the Banca tin is made to assume in these plugs insures that mere pressure shall not force the fusible material out of place.

THE SCRAP HEAP.

Notes.

The Atchison, Topeka & Santa Fe has been fined $100 in the United States Circuit Court at Chicago, for keeping cattle in cars 108 hours without food or water.

The New York Central has increased the pay of telegraph operators; of certain other station employees on the R., W. & O. Division, and of 250 employees in the shops at Oswego.

General Passenger Agent Daniels, of the New York Central, says that his road recently took a boat load of corn at Buffalo on Saturday afternoon, loaded it into cars, took it to New York (440 miles), and delivered it into an ocean steamship, the "Cedric," Monday afternoon.

The State Railroad Commission of South Carolina has issued an order requiring all railroads to supply shippers with empty cars within four days after written demand; or three days, if the freight is perishable. If the freight is not in sight, or the company doubts the shipper's intention, a deposit of $2 a car may be required.

The new railroad law of Cuba, an abstract of which was recently published in the *Railroad Gazette*, is to go into effect May 12. Some of the clauses have been modified so as to reduce the punishment for certain offences. The order announcing the changes also fixes passenger rates, and provides for shipping goods through over two or more railroads.

A press despatch from Knoxville, Tenn., says that Mr. John B. Newton, formerly General Manager of the Atlanta, Knoxville & Northern, has received from Henry McHarg, former owner of the road, a gift of $25,000; and that Mr. McHarg will give each of the 1,000 employees one month's salary as a present. The road was recently sold to the Louisville & Nashville.

The Interstate Commerce Commission in opinions by Commissioner Prouty has decided the cases of Hawkins against the Wheeling & Lake Erie and the Lake Shore & Michigan Southern. In the first case the Commission awarded the complainant $100 as reparation for damages resulting from unjust discrimination in furnishing cars,

and in the case against the Lake Shore $200 reparation was awarded for like damages.

The newspapers of Pittsburgh report that the congestion which existed in the freight yards of that city a few months ago has never been entirely relieved, and is now about as bad as it ever has been. Carload shipments sent westward suffer very serious delays. It was recently stated in one of the papers that the Carnegie Company had sent five cars of steel to Chicago, by way of the Buffalo, Rochester & Pittsburgh and the Michigan Central roads; this in order to get the goods to their destination sooner than could be done by the direct routes; though the cost was no more by way of Buffalo than it would have been by the regular route.

Commerce of France in 1901.

According to the consular report, Great Britain heads the list of countries from which France imported merchandise during 1901, with exports to France of $128,812,796. The United States is second with $93,002,261. Germany is third with $80,613,591. Belgium is fourth and the Argentine Republic fifth, the last named being especially prominent owing to the wool and animal-product trade. In exports from France to the principal countries, Great Britain's imports amounted during the year to $243,984,810. Belgium imported from France merchandise to the value of $115,128,553; Germany, $89,028,198, and the United States was fourth with $46,226,202. The Argentine Republic imported from France less than $10,000,000 worth of goods and stands eighth in the list.

Cornell University.

Mr. W. M. McFarland, Acting Vice-President of the Westinghouse Electric & Mfg. Company, will deliver a lecture on "Electric Power Distribution in Manufacturing" at Cornell University on Friday, May 9th. The several different systems of distribution and their relative advantages will be discussed, and the manner of applying electric motors to machinery will be illustrated by a large collection of stereopticon views.

Fast Time on the Wabash.

The following from the St. Louis *Republic* of April 11 is sent out by the Wabash passenger department, and therefore may be taken as official: The Wabash "Continental Limited" made a new record Thursday night between Decatur and St. Louis, cutting two minutes off the best previous record. Engineer Braddock, with No. 607, a new engine, made the 105 miles from Decatur to Granite City in 101 minutes. A five-minute stop was made at Litchfield, making the actual running time 96 minutes, an average of 65.4 miles an hour. From Staunton to Carpenter, 10.2 miles, the time was seven minutes, or at the rate of 87.42 miles an hour. The train had, besides the regular equipment, President Ramsey's private car.

Chicago & Alton Premiums.

In accordance with its plan established Jan. 1, 1900, the Chicago & Alton has awarded premiums to 48 of its employes for the six months ending Dec. 31, 1901, amounting to $1,215. The plan provides for the payment of semi-annual premiums to enginemen and firemen, conductors and brakemen, agents and operators, based on the records of the men. In road service merits are awarded for economy in the use of fuel, for making scheduled time, for the greatest number of cars moved in freight trains, for promptness and accuracy in reports, cleanliness of cabooses and stations, cleanliness of cars and engines, and economy in the use of supplies. In the case of agents and operators, answering of telegraph calls, transmission of telegrams, reporting of trains. In the case of all employees, good judgment used in emergencies. Demerits are given in case of a breach of the rules or of accidents, and for rough handling of passenger trains.

In road service enginemen and freight conductors receive $40; brakemen and firemen $20. In yard service conductors and enginemen receive $20. Agents and operators, where the position is joint, receive $20, while agents receive $15 and operators $10.

The Washington Union Station.

A bill has been introduced in the U. S. Senate providing that the proposed Union passenger station shall be built by the District of Columbia, instead of by the railroads which shall be allowed the use of the station and terminals on the payment of rent, the money necessary to be raised by a bond issue of $10,000,000.

American Building Records in England.

Messrs. J. Stewart & Co., the American contractors who are building the Manchester Works of the Westinghouse Electric & Mfg. Co., have made a remarkable record for quick time. The huge brick chimney of the generating station of the Mersey Railway Company at Liverpool which was begun last Christmas and which is about 250 ft. high, has just been finished. The work has been carried out by the British Westinghouse Co., which has the contract for converting the Mersey Ry. tunnel from steam to electric traction. Messrs. Stewart & Co. are also building new works for the Westinghouse Co. at East Pittsburgh and at Trafford Park near Pittsburgh.

Second-Class Mail Rates for Railroad Publications.

Justice Bradley, in the Supreme Court of the District of Columbia, on May 6 gave a decision in the case brought by the Railway Equipment and Publication Company, against Postmaster-General Henry C. Payne, for an injunction to prevent the Postmaster-General from charging the third-class instead of the second-class rate of postage on "The Pocket List of Railroad Officials." The injunction is continued, preventing the Postmaster-General from refusing to carry "The Pocket List" at the lower rate of postage. Justice Bradley also decided two mandamus cases involving "The Official Railway Guide" and "Official List." The purport of the decision is that the regulation promulgated by the Postmaster-General goes beyond the law, and is practically an amendment of the law, which the Postmaster-General had no power to make. The Justice ordered writs to issue restoring the second-class privilege to the publications involved.

Massachusetts Criminal Law for Overcapitalization.

A press despatch from Boston says that the Massachusetts Railroad Commission has taken measures toward the prosecution of a railroad company for overcapitalization. The Commission has rejected the petition of the Concord & Boston Street Railway Co. for the issue of $50,000 additional stock, and has reported the result of its investigations to the Attorney-General, with a view of bringing criminal proceedings against the directors of the road. Last December the company applied for authority to issue $50,000 additional stock and gave $100,000 as the appraised value of the road. The commission investigated the assets, hiring an expert for the purpose. It is alleged that the expert was misled by the company. A second expert in the employ of the Commission found many discrepancies in the reported valuation of assets. At one of the hearings it was brought out that the contract for building the road at an excessive figure was given to contractors who were practically made up of the directors of the concern.

LOCOMOTIVE BUILDING.

The New York Central & Hudson River is having 25 locomotives built at the Schenectady Works of the American Locomotive Co.

The Canadian Pacific is reported to have placed an additional order for 26 locomotives, which will bring the total number, contracted for but not delivered, to 90.

CAR BUILDING.

The Gulf & Ship Island has asked prices on 500 flat cars.

The Wisconsin Central has ordered three postal cars from the Pullman Co.

John Smith has ordered 1,000 coal cars from the American Car & Foundry Co.

The Buffalo & Susquehanna is having a coach built at the Barney & Smith Works.

The Mineral Range has ordered 100 ore cars from the American Car & Foundry Co.

The Wadley & Mt. Vernon has ordered a coach from the American Car & Foundry Co.

The Chicago, Rock Island & Pacific has ordered 1,000 box cars from the American Car & Foundry Co.

The Delaware & Hudson has ordered 300 gondola and 200 flat cars from the American Car & Foundry Co.

The Mexican Ry. is having three coaches built at the Wilmington Works of the American Car & Foundry Co.

The Burlington, Cedar Rapids & Northern has ordered some new coaches from Barney & Smith. Number not known.

The Southern has ordered four postal cars from the American Car & Foundry Co., besides those ordered last January.

Reid's Newfoundland R. R. has ordered 50 flat cars from the American Car & Foundry Co., in addition to the order reported in our issue of March 28.

The St. Louis & San Francisco has ordered 500 coal, 150 flat and 100 hopper cars, and 45 cabooses from the American Car & Foundry Co., in addition to recent orders.

The Evansville & Terre Haute has ordered 300 coal cars of 80,000 lbs. capacity, and 100 box cars of 60,000 lbs. capacity from the American Car & Foundry Co., for September delivery. The coal cars will be 36 ft. long; 9 ft. 4 in. wide, and 46½ in. high, and the box cars will be 38 ft. long; 8 ft. 3 in. wide, and 6 ft. 10 in. high. The special equipment includes Sterlingworth brake-beams, Westinghouse air-brakes, Tower couplers, Dunham doors, Miner draft rigging, Diamond trucks and American Car & Foundry Company's wheels.

The Cincinnati, Hamilton & Dayton order for 300 gondola cars, reported April 25, includes the following specifications: Capacity, 70,000 lbs.; weight of car, 26,700 lbs.; length, 36 ft.; width, 9 ft. 10½ in.; height, 7 ft. 10 in., to be built of wood with wooden underframe. The special equipment includes Carnegie steel axles; Simplex body bolsters and trucks; Sterlingworth brake-beams; cast-iron brake-shoes, Westinghouse brakes, Buckeye couplers, Butler draft rigging, American dust guards, cast-iron journal boxes, steel journal box lids, mineral paint, Detroit springs and Diamond trucks.

BRIDGE BUILDING.

AKRON, OHIO.—A bill has passed one branch of the State Legislature which authorizes the removal of all grade crossings in Akron, as well as in other cities in the State. The present bill requires that the railroads and the municipalities shall each pay 50 per cent. of the cost, and also provides that the city can order crossings eliminated wherever it deems necessary.

ALLEGHENY, PA.—The President has signed the bill authorizing the Western Bridge Co. to build a bridge over the Ohio. It is said the structure will be built for the Pittsburgh Railways Co.

ANDERSON, IND.—Bids are wanted May 21 by the County Commissioners for a high truss bridge 100 ft. long over Fall Creek. M. H. Downey, County Surveyor.

ANN ARBOR, MICH.—The City Engineer has been ordered to make plans and specifications in regard to rebuilding the Wall street bridge.

ARKANSAS.—We are told that the contract for the steel bridge to cross the White River in Arkansas, on the line of the White River Ry., an extension of the Missouri Pacific, has not yet been let. The other bridges on this line have all been provided for, as far as the location has proceeded.

BELLEFONTE, PA.—A bridge will be built over Spring Creek from West Lynn street.

BOSTON, MASS.—The War Department has approved the plans for the proposed Cove street bridge across Fort Point Channel, on condition that the draw-openings shall be not less than 50 ft. wide.

The Mayor has received an estimate on the proposed new bridge over the New York, New Haven & Hartford and Harvard street, Dorchester. The City Engineer estimates that a bridge the width of the present street, 45 ft., will cost $3,100.

The Metropolitan Park Board is preparing to build a bridge across the Mystic River between Medford and Somerville, known as the Wellington bridge. It is said that the Board will soon be ready to advertise for bids.

The Metropolitan Park Commissioners contemplate building a boulevard bridge over the Saugus River between the Point of Pines and the city of Lynn.

BUFFALO, N. Y.—The City Council has reduced the appropriation for the bridge over Scajaquada Creek at Sprenger avenue from $7,000 to $3,000. The item of $36,500 for a bridge over Buffalo River at South Park avenue has been reduced to $12,000.

CALDWELL, OHIO.—Bids are wanted May 29 for a steel bridge for the county. H. L. Hastings, County Auditor.

CANTON, OHIO.—Bids are wanted May 31 by the County Commissioners for a bridge and two abutments over the West Branch of the Nimishillen Creek at Linden avenue. Wm. Reed, County Auditor.

CHAMBERSBURG, PA.—Viewers have reported favorably in regard to building a bridge over the creek on Market street.

CHATTANOOGA, TENN.—J. J. Newport, C. B. Sevier and T. A. Christman are the committee appointed to receive bids for building a 156-ft. steel bridge over Emery River.

CHAUMONT, N. Y.—We are told that the contract has not yet been let for the drawbridge over Chaumont Bay, for the New York Central & Hudson River R. R.

COLONA STATION, ILL.—The Chicago, Rock Island & Pacific is taking down the double-track bridge near Colona Station, on the Illinois Division, and is replacing it with a series of 78-ft. girders, putting in piers between the present piers. The masonry work is being done by the company and the girders have been let to the American Bridge Co.

COLORADO SPRINGS, COLO.—According to report, it is probable that the bridge over Shook's Run will be built pretty soon, as the required amount of money, $4,400, is now available.

COLUMBUS, GA.—The contract for building the bridge over Chattahoochee River at Fourteenth street has been let to the American Bridge Co. at $35,000. The contract for the substructure is not yet let.

COLUMBUS, OHIO.—We are told that plans are being made for the proposed viaduct over the railroad tracks on Cleveland avenue. The only detail to be arranged is the division of the cost between the various railroad companies passing under the viaduct, and the street railroad company passing over it and the county. The county will assume 20 per cent. of the cost. The work will be done under the jurisdiction of County Surveyor Henry Maetzel.

CROTON FALLS, N. Y.—The contract for the drawbridge over Croton River, for the New York Central, has been let to the American Bridge Co.

DEERFIELD, MICH.—It has been voted to raise $7,000 for a bridge at the foot of Raisen street. W. T. Atkins, Supervisor.

DEER ISLE, ME.—The Town Council has appropriated $1,000 toward building the $4,000 bridge from Sunshine across the bar to Deer Isle.

EASTON, PA.—The county officers have decided to build a new low truss bridge at Beaver Brook.

EGGLESTON, MINN.—Bids are wanted May 22, according to report, for a bridge at this place. C. A. Sargeant, County Commissioner, Red Wing.

FAIRMONT, W. VA.—According to report, the War Department has ordered the Baltimore & Ohio to remove the old Fairmont, Morgantown & Pittsburgh bridge over the Monongahela just below this place.

FAIRPORT, N. Y.—We are told that the State will build a new bridge over the Erie Canal at Caledonia avenue, Rochester, and that the bridge at Rochester will be moved to this town. F. E. Pritchard, Superintendent of the Municipal Board.

GALT, CAL.—The Board of Supervisors propose to build a highway bridge across the Mokelumne River, near Galt.

GENEVA, N. Y.—Bids are wanted about June 1 by the Board of Public Works for a girder bridge over Marsh Creek. W. S. Wood, Clerk.

GRAFTON, N. DAK.—The Board of County Commissioners on May 13 will decide how many bridges will be built this year, and on May 15, 1 p.m., will let contracts. O. M. Fraser, County Auditor.

GOSHEN, N. Y.—Bids are wanted May 12 for building the abutments of two bridges. V. K. Mills, Engineer.

HAMILTON, ONT.—The City Council will ask the Grand Trunk Railway to build a bridge over the tracks at Strachan street.

HENDERSON, MINN.—Bids are wanted May 17 for a bridge over Rush River. E. J. Ayer, Town Clerk.

HOBOKEN, N. J.—The Board of Freeholders are considering improving the Paterson Plank-Road by building a viaduct from a point near the West Shore R. R. tracks to Harrison street, Hoboken. It is said plans have been made.

INDIANAPOLIS, IND.—Bids are wanted May 10 by the Commissioners of Marion County for building the approach to a bridge on Fall Creek on Oakland and Germantown road.

The County Commissioners have rejected all of the bids received on May 1, for bridges in Pike Township. New bids will be advertised for.

JERSEY SHORE, PA.—A site will shortly be selected for the new trolley line bridge over Pine Creek.

KANSAS CITY, KAN.—According to local report the committee on bridges and viaduct will let the contract for the Tenth street viaduct at its next meeting. The cost will be about $90,000.

MERRITT, FLA.—According to report, a bridge will be built across Indian River at the foot of Ocean street.

MUNCIE, IND.—The Wabash Bridge & Iron Co. has the contract for all the steel bridges on the extension of the Cincinnati Richmond & Muncie. They vary in length from 400 to 680 ft. Howland & Hood have the contract for the wooden approaches to these bridges.

ONEONTA, N. Y.—We are told that a steel bridge will be built over the Delaware & Hudson tracks on Main street at a cost of about $75,000.

A bridge about 60 ft. long will be built near this place. Address Chas. H. Bowdish.

OSHKOSH, WIS.—The committee of the Common Council is considering with the Manager, E. E. Downs, of the interurban road, the matter of rebuilding the bridge at West Algoma.

OXFORD FURNACE, N. J.—Bids are wanted until 3 p.m., May 10, for a low-truss iron bridge over Beaver Brook.

in Oxford Township. Separate bids are wanted on the masonry. W. A. Henderson, Commissioner.

PEORIA, ILL.—It is said plans have been made for a viaduct that will cross about 21 tracks crossing Sanger street, and that work will be begun soon.

PIERRE, S. DAK.—In the House of Representatives on April 29 a bill was introduced and referred to the Committee on Interstate and Foreign Commerce, authorizing the Duluth, Pierre & Black Hills R. R. to build a bridge across the Missouri River at Pierre.

PITTSBURGH, PA.—The Pittsburgh, Shawmut & Northern will need some bridges. (See Railroad Construction.)

PORTAGE LA PRAIRIE, MAN.—The Council is considering the matter of getting aid toward rebuilding the Assiniboine bridge.

PROVIDENCE, R. I.—The Builders Iron Foundry propose to build a bridge over Codding street.

READING, PA.—Viewers have recommended that the county build a two-span bridge over Mill Creek in Toledo Township at a cost of about $1,500.

REXFORD FLATS, N. Y.—The contract for the 625-ft. steel bridge over the Mohawk for the Schenectady Ry. Co. is let to the American Bridge Co.

RICHMOND, VA.—The Richmond Flour & Feed Co. will build a bridge over a street between its warehouses.

ROCHESTER, N. H.—A committee of the City Council has had plans made for an iron bridge over Salmon Falls River.

ROCHESTER, N. Y.—The Commissioners have voted to have plans and specifications made for a stone bridge and also for a concrete and steel bridge; also for an entire steel bridge on the site of the Vincent street bridge over Genesee River. The kind of bridge to be decided later.

A new bridge will be built by the State at Caledonia avenue, and the present bridge will be moved to the town of Fairport.

ST. CHARLES, MO.—Bids are wanted May 13 by C. Edwards, County Surveyor, for four steel I-beam bridges.

SAN SABA, TEXAS.—It is said that the county has voted to issue $17,000 of bonds for building three bridges over Colorado River.

SCRANTON, PA.—The Lackawanna & Wyoming Valley Railroad will build a double-track bridge over Roaring Brook, a short distance north of the Pittston avenue city oridge.

SHOSHONE, IDAHO.—We are told that the Twin Falls Irrigation Co. will build a steel bridge, 1,000 ft. long, across Snake River. Address I. B. Perrine, at this place.

SIOUX CITY, IOWA.—Felix Jauron, of Salix, a member of the Board of Supervisors, is reported as saying that the Board will build five new bridges this season.

SUNBURY, PA.—The Sunbury Bridge Co. has filed notice of application for incorporation to build a bridge over the Susquehanna River at this place.

TENNESSEE.—On April 30 a bill was introduced in the House of Representatives authorizing the Harriman Southern R. R. to build a bridge across the Tennessee River in Tennessee.

TERRE HAUTE, IND.—It is said that bids are wanted May 10 for a bridge in Fayette Township. James Soules, County Auditor.

VICKSBURG, MISS.—We are told that the Vicksburg National Park Commission will be ready to ask bids within about two months for building two viaducts on the park site, namely, one across Glass' Bayou, 300 ft. long, and the other over Stout's Bayou, 375 ft. long. Wm. T. Rigby, Chairman of the Commission.

VIRDEN, MAN.—Bids are wanted until May 28 for a steel bridge across the Pipestone Creek eight miles from Reston. A. P. Power, Secretary and Treasurer.

WEST CHESTER, PA.—The County Commissioners are considering building a bridge over Buck Run on the public road between Cochranville and Newlin Station.

WHITE HAVEN, MD.—According to report, a drawbridge will be built over the Wicomico River at White Haven.

YORK, PA.—The County Clerk is advertising for bids for the masonry work for four bridges.

Other Structures.

BOONVILLE, MO.—In regard to building a new passenger station in this city, an officer of the Missouri, Kansas & Texas tells us that the plans have not advanced far enough to give a definite statement.

BUFFALO, N. Y.—According to local report, a company is being formed of the local grain dealers to build a large steel elevator on Black Rock Harbor.

CANTON, OHIO.—The Canton Bridge Co. has begun work on the addition to its plant, as previously mentioned. These improvements will include a new blacksmith and template shops and an addition to the main structural plant. The total outlay will be about $75,000.

CLAIRTON, PA.—The St. Clair Steel Co. has decided to add a Bessemer steel mill to its plant now building at Clairton.

ERIE, PA.—The Ball Engine Co., according to report, will, in a short while, increase the size of its plant.

FALLSBURG, N. Y.—The New York, Ontario & Western will build a new station in Fallsburg.

JANESVILLE, WIS.—The contract for building the new passenger station for the Chicago, Milwaukee & St. Paul in Janesville, has been let to G. A. Johnson & Sons of Chicago. The new station will cost $30,000.

JERSEY CITY, N. J.—The repair shops of the Erie R. R., at the west end of the Bergen tunnel, were destroyed by fire May 5.

KENTON, OHIO.—The works of the Champion Iron Co. have been totally destroyed, the loss being $250,000. The concern made jails, bridges, architectural iron and other work.

KEYSER, W. VA.—Bids for the first improvements to be made by the Baltimore & Ohio at this point are being received. The work includes a roundhouse and a coaling station.

MCKEESPORT, PA.—It is said that the National Tube Co. has abandoned its plan to rebuild its large tube works at McKeesport. There are conflicting reports that the company has recently bought additional land for the enlargement of its works.

MILWAUKEE, WIS.—The directors of the Milwaukee road have authorized improvements to the West Milwaukee shops. It is said the cost will be fully $800,000.

MONACA, PA.—Plans for doubling the capacity of the new Vulcan Crucible Steel Works at Monaca have been made, according to report.

PHILADELPHIA, PA.—The Directors of the William Cramp & Sons' Ship & Engine Building Co., have authorized $4,000,000 for improvements and extensions to the plant.

PITTSBURGH, PA.—It is said the Wabash, within a few weeks, will take up plans for building the proposed stations along the Pittsburgh extension, which number about 25.

Jones & Laughlins, Ltd., will make some extensive improvements to the Soho shops.

The Keystone Valve & Mfg. Co., just incorporated with $100,000 capital, proposes to build a plant in Carson street, Southside. Among those interested are Henry E. Keys, of Homestead, and J. B. Riley.

PITTSFIELD, MASS.—The works of the Stanley Electric Co. will, in the near future, be considerably enlarged. Mr. Vreeland, of the Metropolitan Street Ry., New York, and others interested in that company, recently made an inspection of the works and were reported by the newspapers to have made a statement to the effect that these shops will do a great amount of work for the company, thereby necessitating the extensions.

PORTSMOUTH, N. H.—It is said that bids are about to be received for the new office building for construction and repair, to cost $35,000.

RUTLAND, VT.—According to report, Dr. Webb, of the Rutland R. R., has assured the people of this city, that the new passenger station will be built this year. It is not yet decided to locate the new shops in Rutland.

ST. LOUIS, MO.—It is said that John E. Roebling's Sons Co., of Trenton, N. J., is negotiating for a large tract of land near St. Louis on which a western plant will be built.

SIOUX CITY, IOWA.—The contract for building the new shops for the Chicago, St. Paul, Minneapolis & Omaha is let to Geo. J. Grant, of St. Paul, Minn. The actual cost of the construction of these buildings is given at $269,000. The machinery and terminal contracts will cost $150,000 additional. Mr. Grant's contract calls for machine and car shops, a 15-stall engine house, power house, boiler house, blacksmith shop, paint shop, transfer pit, turntable and three other buildings.

WASHINGTON, D. C.—The House of Representatives on April 29 passed the bill providing for public buildings at different points in 45 States and territories, and known as the "omnibus" bill. In it provision is made for 77 new buildings and sites, six buildings on sites already bought, 17 buildings on sites given for that purpose, and 58 increases in appropriations previously made. The total amount carried by the bill is $17,405,450, whereas the appropriations asked on separate public buildings bills already introduced in Congress amount to $66,975,936. Among the buildings provided for in the bill are a Municipal building and site for Washington, D. C. The appropriation for buildings for the National Bureau of Standards is increased from $250,000 to $350,000, which makes it possible to erect two buildings. Other buildings provided for are a new postoffice at St. Louis, the site and building to cost $550,000, and for a building and site at Providence, R. I., to cost $1,000,000.

A new postoffice building at New York is not provided for, but the bill provides for a commission to select a site in Manhattan.

Estimates have been sent to the House of Representatives by the War Department for additional barracks, stable, gun sheds and officers' quarters at Fort Myer, Va., to cost $159,356, and to accommodate the increased garrison at that point.

In accordance with a provision of the Sundry Civil appropriation bill of last year, a report has been submitted to Congress by Mr. Elliott Woods, Superintendent of the Capitol building, on the proposition to extend the East front of the central part of the building to be on a line with the House and Senate wings, and to remodel and redecorate the interior of the rotunda. The idea of extending the East front of the Capitol was first considered in 1859. Mr. Woods estimates that the extension would cost $2,500,000 and that the proposed improvement of the rotunda would cost $275,000.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xviii.)

Canadian Society of Civil Engineers.

At the meeting on Thursday, May 8, the paper was "A Standard Railroad Specification," by J. S. Armstrong.

Railroad Accounting Officers.

C. G. Phillips, Secretary and Treasurer of the Association of American Railway Accounting Officers, is making arrangements for the fourteenth annual convention of the Association, which will be held in the Southern Hotel, St. Louis, Mo., on Wednesday, May 28.

Richmond Railroad Club.

The regular monthly meeting of the Richmond Railroad Club was held at the rooms of the Railroad Y. M. C. Association, Main Street Station, May 8, at 8 p. m. The paper discussed was "Modern Car Design and Construction," by Mr. C. A. Seley, Mechanical Engineer N. & W. R'y, Roanoke, Va.

Engineers' Club of St. Louis.

A regular meeting was held on Wednesday, May 7, at 8 p.m. Mr. A. S. Langsdorf presented a paper, entitled, "Commercial Testing of Electrical Machinery." He described the usual factory tests applied to alternating and direct current machinery, as practiced by the largest manufacturers. Illustrations of the electrical connections were given.

American Society of Civil Engineers.

At the meeting held on Wednesday, May 7, a paper by George S. Webster and Samuel Tobias Wagner, Members, Am. Soc. C. E., entitled "The Pennsylvania Avenue Subway and Tunnel, Philadelphia, Pa.," were presented by Mr. Webster and illustrated with the stereopticon. This paper was printed in the March number of *Proceedings.*

Central Railway Club.

Mr. W. H. Marshall having declined the office of Vice-President of the Club for the ensuing year, the President appointed W. T. Burton, T. Rhodes and J. A. Bradley a committee to nominate candidates for the vacancy. They have agreed upon J. R. Slack, of Albany, Superintendent Motive Power, Delaware & Hudson R. R., and J. A. Barhydt, Rochester, N. Y., Master Mechanic, Buffalo, Rochester & Pittsburgh R. R.

St. Louis Railway Club.

Officers were elected at the meeting held April 11, as follows: President, John J. Baulch, re-elected; First Vice-President, A. T. Perkins, Superintendent of Terminals, St. L., K. & N., St. Louis; Second Vice-President, H. C. Barnard, Superintendent of Terminals, Southern Ry., East St. Louis, Ill.; Third Vice-President, S. M. Dolan, M. M. and F. C. D., Wiggin's Ferry Co., East St. Louis. Both E. A. Chenery, Secretary, and S. G. Scarett, Treasurer, were re-elected. George B. Leighton was elected to the Executive Committee succeeding Mr. Dolan, elected Vice-President.

The paper read at this meeting was "The Use of Steel in Car Construction," by J. W. Stokes.

Car Foremen's Association of Chicago.

The regular meeting of the Car Foremen's Association of Chicago will be held in room 209, Masonic Temple, Chicago, Wednesday, May 14, at 8 o'clock p.m. The following programme has been arranged:

1. Discussion of Report of Committee to present a code of Rules for the examination of applicants for the position of Car Inspector.
2. Should delivering line inspector be required to sign joint evidence statement covering defective condition of car in cases where any wrong repairs are in existence?
3. Discussion of that part of the report of the Committee on Repair Track Facilities and Appliances which refers to the clerical work in connection with the repair tracks.
4. Discussion of M. C. B. Rules 4, 5 and 6.

New York Railroad Club.

The next regular meeting of the New York Railroad Club will be held at No. 349 Madison avenue, New York, at 8 o'clock p.m. of Thursday, May 15th.

The thirtieth anniversary of the Club's organization occurs this spring, and as the Executive Committee learned that on the 28th of April it was 50 years since one of the original members of this Club, Mr. M. N. Forney, commenced his railroad career by entering a machine shop as an apprentice, they thought it might be interesting to have him give a review of events which have transpired under his observation since then, and relate some of his experience during that period. He was therefore invited to address the Club at its May meeting, and he has consented to do so. The title of his address will be "Reminiscences of Half a Century."

Railway Signaling Club.

The next meeting of this Club will be held at the Great Northern Hotel, Chicago, on Tuesday, May 13, at 2:30 p.m. The principal paper will be one on "Interlocking Construction and Specifications," by Mr. C. O. Tilton, Signal Inspector of the Chicago, Milwaukee & St. Paul. An abstract follows.

The fact that many inquiries reach the different roads for their specifications would seem to justify a short article on this subject. A general plan should never be drawn up without first going over the ground so that the interlocking station may be located where the best view will be obtained and the best lead out and pipe lines at street or road crossings heavy boxing should be provided. Provision should be made for any possible additional track in the future and the interlocking station located so as to allow for it. The expression "interlocking station" conforms to the latest nomenclature of the American Railway Association. In numbering up a plan [for a crossing] the levers should be grouped for each road as this saves walking on the part of the signalman, especially at a large machine.

Derails should be put at least 500 ft. from the fouling point on high speed lines, and deflect towards the greatest angle. Pipe lines should be run on the opposite side of track from derails, as a derailed train can do considerable damage to a pipe line if it leaves the track. To keep a derailed train on the track it is well to use a short guard rail.

Concrete foundations are to be preferred to wood, are not as expensive as iron, and can easily be made on the ground. Signal poles, crank and compensator tops should be of iron, or the cranks and compensators may be set on iron anchor posts imbedded in concrete. Experience has shown that interlocking plants with wooden poles and foundations have to be practically rebuilt every six years. Put no boxing on pipe lines; the pipe does not rust as quickly, and it is certainly more accessible.

Levers should not be overloaded. A derail at 500 ft. worked with a switch and lock movement is sufficient load for one lever. Facing point switches should be worked with facing point locks and derails and switches be bolt locked with their respective home signals whenever practicable. The bolt lock is really the key to the situation, as otherwise we have to depend entirely upon the plunger of lock entering hole in lock rod.

All derails, switches and home signals should be worked with pipe. As the double spectacle casting comes into general use, with green for clear, it is necessary to have the home signal more positive in its action as it requires the lower opening in d e spectacle to properly cover the lens of lamp so the green light may show to advantage. Selectors should not be used and mechanical distant signals and dwarf signals should be worked by two lines of wire.

Where it is necessary to have a two arm home signal, it would seem good practice to put the lower arm, for the diverging route, on the same pole about 10 ft. from the top of rail, blinding the light in the normal position. The engineman will then always get a high signal for his main line high speed route, and will not be running against a red light at night; and the possibility of a false indication being given at night by a broken spectacle glass (with the white light for a clear signal) is lessened.

Electric locking is now looked upon as one of the essential features of an up-to-date interlocking plant, but the subject has been recently discussed before the club. In regard to distant signals there is a great difference of opinion. Would it not be a good idea to locate the distant signal 3,000 ft. from the home signal? It should be of the automatic semaphore type, as a wire connected mechanical signal at this distance is not a good working signal and cannot compare with the automatic signal in reliability. The automatic signal ready for service will cost about $300, and the mechanical signal $150.

PERSONAL.

—Mr. William Wagner, who was for many years Secretary of the Denver & Rio Grande, died at his home in Short Hills, N. J., Saturday, May 3, aged 65 years. Mr. Wagner was born in Philadelphia and was a member of the military order of the Loyal Legion of the United States.

—Mr. L. L. Buck has retired from the position of Chief Engineer of the Bridge Department of New York City, to take that of Consulting Engineer of Bridge No. 2. This latter is the new suspension bridge which Mr. Buck designed, and which so far has been built under his charge. His reluctance to resign from the office of Chief Engineer of the Department was principally because he felt that it was his duty to the City of New York to finish this bridge. Under the present arrangement he will be able to do so; that is, the bridge will be carried out on his plans and with no change in design or in staff, except by his consent.

—Mr. Edward J. Chibas, M. Am. Soc. C. E., has resigned the position of Chief Engineer and General Manager of the Guantanamo Railroad in Cuba, in order to give his whole time to professional business as a consulting and contracting engineer. His office now is in Santiago de Cuba. He continues, however, to act as consulting engineer for the Guantanamo Railroad. He has on hand a number of contracts, awarded by the American Military Government and the Department of Public Works. These contracts include various works around Santiago, and a wharf at Gibara on the north coast of the Province. This wharf is nearly one-third of a mile long.

—Mr. E. G. Schevenell, the new Division Superintendent of the Chicago & North Western at Mason City, Iowa, is a native of Alabama, having been born at Marion in 1863. His railroad service dates from 1879, when he was telegraph operator for the Houston & Texas Central. This position he held for one year, at the end of which time he went to the Missouri, Kansas & Texas. From 1882 until 1893, when he became Trainmaster of the Chicago & Alton, Mr. Schevenell was despatcher on various roads. In 1895 he was appointed Chief Despatcher and Assistant Superintendent on the Chicago & North Western and discharged these duties until his recent appointment as stated above.

—Mr. E. J. Pearson, who was recently promoted to the position of Assistant General Superintendent of the Northern Pacific, was born at Rockville, Ind., in 1863. He was educated at Cornell University and entered railroad service in 1880 as a rodman on the Missouri Pacific. For two years (1883-1885) he was Assistant Engineer for the Northern Pacific and remained with this company in the Engineering Department until 1892, when he became Principal Assistant Engineer of the Chicago & Northern Pacific and the Wisconsin Central. He returned to the Northern Pacific two years later as Superintendent of the Missouri & Yellowstone Division and in 1895 he was transferred to the Rocky Mountain Division. In 1897 he was transferred to the Pacific Division.

—The new Mechanical Engineer of the Chicago, Rock Island & Pacific, Mr. C. A. Seley, was born at Wapella, Ill., in 1856. He began his railroad service in 1879 as a draftsman for the St. Paul, Minneapolis & Manitoba. For the five years, 1881-1886, he was engaged in other mechanical engineering work, and in the last named year he became Chief Draftsman for the St. Paul & Duluth; and in 1888 he went to the Great Northern. He remained with this company until 1892, when he resigned to go into the railroad supply business, but in 1895 returned to the railroad service, taking the position of Chief Draftsman of the Chicago Great Western. In 1899 he was appointed Mechanical Engineer of the Norfolk & Western and discharged these duties until his new appointment, which took effect May 1, last.

—Mr. Ira A. McCormack, who for some time past has been General Manager of the Cleveland (Ohio) Electric Railway, has resigned to become Assistant General Manager of the Harlem Line of the New York Central & Hudson River. The Harlem Line, of which Mr. J. H. Franklin is Manager, is the name applied to the Grand Central Station, with its yard, and the main tracks out as far as Mott Haven, five miles. This five-mile line, a part of the original Harlem Railroad, is traversed by the trains of all of the three railroads which use the Grand Central Station; the New York Central, the Harlem Division of the New York Central, and the New York, New Haven & Hartford. Mr. McCormack began his railroad service as a telegraph operator on the Pittsburgh & Connellsville. He has also served in the station and train service and for a time was on the Pittsburgh & Lake Erie. After serving as trainmaster of the Hudson River Division of the New York Central, and being for a time with the Hall Signal Company and the Lake Shore & Michigan Southern, he went, in 1895, to the Brooklyn Heights (Street) Railway. In 1899 he resigned the Brooklyn General Superintendency and took a similar place in Syracuse, whence he went to the place in Cleveland which he has just left.

—The death of Mr. C. Y. O'Connor, C.M.G., M. Inst. C.E., removes a distinguished engineer. Born in Ireland in 1843, the field of his success was Western Australia, of which colony he was appointed engineer-in-chief in 1891, and which position he held until the time of his death. His reputation rests upon two famous enterprises. The one was, in the face of great opposition, converting the coast town of Freemantle, at the mouth of a barlocked river, into an ocean port, with a harbor 30 ft. deep. The other, and bolder feat was the Coolgardie water supply. This project is to convey 5,000,000 gallons of water a day, from the Helena River, 328 miles inland, to the Coolgardie gold fields. A steel pipe line 30 in. in diameter is run Coolgardie from the coast, in a series of steps. A pumping plant is installed at the bottom of what may be called the "riser" in this hydraulic stairway, while the "tread" of each step slopes easily to the next pumping station ahead. Nine pumping stations spaced along the line, force water to the top of the vertical pipes, and it then runs down the succeeding gentle incline by gravity. The algebraic sum of all the rises and falls in the pipe line, shows that the water has not only been carried horizontally 328 miles, but has made a total vertical rise of 1,313 ft. in that distance. The cost of the undertaking was placed at about $13,500,000. The annual operating expenses were estimated at $1,600,000. The cost of delivering water, however, which originally was from 4 to 12 cents for each individual gallon, will, when 5,000,000 gallons are supplied daily, come down to between 84 cents and $1.58 per 1,000 gallons, in a country with a yearly rainfall of but 5 in. The strain of work, and the worry of constant misrepresentations by party politicians, was too much for Mr. O'Connor's highly strung nerves, and in a moment of mental gloom he put an end to his busy and brilliant career.

ELECTIONS AND APPOINTMENTS.

Atlanta & West Point.—W. N. Cox has been appointed Assistant Master Mechanic, with headquarters at Montgomery, Ala.

Baltimore & Ohio.—L. G. Haas, heretofore Assistant to the General Manager, has been appointed General Superintendent at Pittsburgh, Pa., succeeding W. R. Woodford, resigned. H. E. Hale becomes Division Engineer Maintenance of Way, with headquarters at Philadelphia, Pa., succeeding E. P. Mobley, resigned. H. B. Dick has been appointed Division Engineer at Newark, Ohio, and J. R. Leighty becomes Assistant Engineer at the same place, and W. B. Poland becomes Division Engineer at Pittsburgh, succeeding G. B. Owen, resigned.

Baltimore & Ohio Southwestern.—The following rearrangement of Divisions has been made: The Ohio Division will include the line from Parkersburg to Cincinnati, exclusive of the Cincinnati terminals, including branches, with W. H. Brimson Superintendent, and H. H. Temple, Division Engineer. Their headquarters will be at Chillicothe. The Indiana Division will include the line from Cincinnati to Washington, Ind., including Cincinnati terminals and the lines from North Vernon to Louisville, Watson to Jeffersonville, and Riverdale to Bedford. L. C. Fritch is Superintendent and J. B. Carothers Division Engineer, with headquarters at Cincinnati; and the Illinois Division covers the line from Washington, Ind., to St. Louis, including the Washington yard and the line from Beardstown to Shawneetown. E. R. Scoville is Superintendent and Earl Stimson Division Engineer, with headquarters in Washington, Ind.

Birmingham Belt.—H. M. Atkinson, of Atlanta, Ga., has been elected President and L. P. Pairo, Vice-President.

Boston & Albany.—The Boston & Albany is now operated in two divisions, known as the "Boston Division" and the "Albany Division." The Boston Division, extending from Boston to Athol Junction, including the branches, will be in charge of J. L. Snelling, as Assistant Superintendent, with headquarters at South Station, Boston, and the Albany Division, extending from Athol Junction to Albany, including the branches, will be in charge of Nath. Wales, as Assistant Superintendent, at Springfield, Mass.

Canadian Northern.—W. Mackenzie has been elected President, with headquarters at Toronto, Ont.

Canadian Pacific.—A. Allan has been appointed Superintendent (Western Division), with headquarters at Moose Jaw, N. W. T., succeeding C. W. Milestone, resigned.

Central of New Jersey.—C. W. Huntington, heretofore Superintendent of Transportation of the Iowa Central, has been appointed General Superintendent of the C. of N. J. S. F. Forbes, Assistant Superintendent of Motive Power, has resigned to become General Manager of the Berwick Malleable Co., with headquarters at Berwick, Pa. J. D. Landis, Purchasing Agent of the Philadelphia & Reading, has been appointed Purchasing Agent of the C. of N. J. G. DeWitt Smith, heretofore Purchasing Agent of the C. of N. J. at Jersey City, is appointed Assistant Purchasing Agent of both companies, with office at Philadelphia.

Chicago Great Western.—A. E. Harvey has been appointed Division Engineer, with headquarters at Red Wing, Minn.

Chicago, Milwaukee & St. Paul.—E. D. Sewall, heretofore General Northwestern Agent, has been appointed Assistant General Superintendent, with headquarters at Minneapolis, Minn. J. T. Conley, heretofore Assistant General Passenger Agent, has been made Assistant General Freight Agent, with headquarters in Minneapolis.

Chicago, Rock Island & Pacific.—H. S. Cable, heretofore Vice-President and Purchasing Agent of the Rock Island & Peoria, has been appointed General Superintendent of the lines West of the Missouri River, of the C., R. I. & P., with headquarters at Topeka, Kan., and W. M. Hobbs, who formerly held the title of General Superintendent of the entire system, will be General Superintendent of the lines east of the Missouri River, with headquarters in Chicago.

C. H. Hubbell, heretofore Superintendent Lines West, has been transferred to Chicago as Superintendent of Terminals. W. H. Stillwell, heretofore Superintendent Lines East, has been appointed Division Superintendent, with headquarters at Des Moines. W. J. Lawrence, Superintendent of the Iowa Division, becomes Division Superintendent at Trenton, Mo., and W. S. Tinsman, heretofore Superintendent of Terminals at Chicago, becomes Division Superintendent at Chickasha.

Denver & Rio Grande.—G. W. Heintz, Assistant General Passenger Agent, with headquarters at Salt Lake City, Utah, has resigned.

Detroit Union Station.—F. E. Dewey has been appointed Manager.

El Paso & South Western.—H. J. Simmons has been made Chief Engineer, in charge of all Maintenance of Way including Buildings and Bridges.

Grand Trunk.—W. D. Robb, heretofore Acting Superintendent of Motive Power, has been appointed Superintendent of Motive Power.

Gulf, Colorado & Santa Fe.—W. E. Symons, heretofore Superintendent of Motive Power of the Plant System, has been appointed Mechanical Superintendent of the G., C. & S. F., with headquarters at Cleburne, Texas.

J. H. Johnston, Assistant General Freight Agent, with headquarters at Galveston, Texas, has resigned.

Hannibal & St. Joseph.—S. E. Crance, General Superintendent, with headquarters at St. Joseph, Mo., has resigned.

Illinois Central.—J. W. Luttrell, Master Mechanic, has resigned. (See Missouri Pacific.)

Interstate.—M. Woodson has been appointed Superintendent. The Superintendent's office is at Stonega, Wise County, Va.

Iowa Central.—C. W. Huntington, Superintendent of Transportation, has resigned. (See Central of New Jersey.) F. H. Davis has been elected Treasurer and A. C. Doan, Secretary.

Kansas City Southern.—B. F. Dickson has been appointed Engineer Maintenance of Way, with headquarters at Kansas City, Mo.

Lake Erie & Detroit River.—F. H. Walker has been elected President, and E. C. Walker, Vice-President.

Lehigh Valley.—J. H. Vought has been appointed Assistant to the Superintendent of Motive Power and is succeeded as Master Mechanic at Weatherly, Pa., by J. H. Fildes.

Louisville & Nashville.—W. P. Bruce, heretofore Acting Superintendent of Terminals at Nashville, has been appointed Superintendent of Terminals.

E. E. Snyder, Division Superintendent at Memphis, Tenn., has been transferred to Louisville, succeeding Daniel Breck; and F. N. Fisher succeeds Mr. Snyder at Memphis.

Macon, Dublin & Savannah.—M. S. Monroe has been appointed Master Mechanic, with headquarters at Macon, Ga.

Missouri Pacific.—J. W. Luttrell, heretofore Master Mechanic of the Illinois Central, has been appointed Superintendent of the Locomotive and Car Department, with headquarters at St. Louis, Mo., succeeding J. O. Pattee, resigned.

Montour.—H. P. McCue has been appointed Superintendent of Transportation, with headquarters at Pittsburgh, Pa., succeeding Charles Porter, resigned.

New York Central & Hudson River.—Charles F. Smith has been appointed Superintendent of Passenger Transportation, effective May 5. Ira A. McCormack, heretofore General Manager of the Cleveland (Ohio) Electric Railway, has been appointed Assistant General Manager of the Harlem Line of the N. Y. C. The Harlem Line is the name applied to the Grand Central Station, with its yard, and the main tracks out as far as Mott Haven, five miles.

Pennsylvania.—J. H. Stadelman, Assistant Engineer at Renovo, Pa., has been transferred to a similar position at Jersey City, succeeding G. B. Beale. D. R. Mehaffey succeeds Mr. Stadelman.

Philadelphia & Reading.—(See Central of New Jersey.)

Rock Island & Peoria.—H. P. Greenough has been elected Vice-President, succeeding H. S. Cable, resigned, and M. A. Patterson succeeds Mr. Greenough as Treasurer.

Rutland.—W. S. Webb, Chairman, has been elected President also. J. W. Smith has been appointed Purchasing Agent, with headquarters at Rutland, Vt.

St. Louis Southwestern.—William E. Green has been appointed General Superintendent, with headquarters at Tyler, Texas, succeeding R. H. Bowron, resigned. Mr. Green also succeeds Mr. Bowron as First Vice-President of the St. Louis Southwestern of Texas.

Seaboard Air Line.—R. E. L. Bunch having resigned the office of General Passenger Agent, the duties thereof will until further notice be performed by W. H. Pleasants, Traffic Manager.

Searcy & Des Arc.—The officers of this company are: President and Treasurer, G. W. Hunter; Vice-President, G. B. Rose, and Secretary and General Manager, C. E. Gibbs.

Southern California.—C. F. Lape, Division Master Mechanic, with headquarters at San Bernardino, Cal., has resigned.

Union Pacific.—H. E. Flavin, Assistant Superintendent at Denver, Colo., has resigned.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALASKA CENTRAL.—This company has been incorporated to build from a point on the north end of Resurrection Bay, Alaska, north to Lake Kenai; thence around the lake to Quartz Creek and through Cariboo Pass, Nenana Pass, and down the Nenana River, eventually reaching Rampart City. The greatest altitude encountered is in the Cariboo Pass and is 2,600 ft., which is reached on either side by a gradual ascent. Geo. W. Dickinson is President and General Manager.

AUBURN INTERURBAN (ELECTRIC).—Notice of a proposed extension from Syracuse to Marcellus, N. Y., 10 miles, was filed at Albany April 22. The company at present operates 8½ miles of line.

CHARITON VALLEY.—This is the correct name of the road referred to April 11 as the Charitan Valley. An officer writes that the plans of the company are not yet sufficiently advanced to say when any contracts are likely to be let, but that surveys have been made. It is proposed to build from Novinger, Mo., to Centerville, Iowa, 45 miles. W. G. Brimson, of Kansas City, Mo., is President.

CHEAT VALLEY.—In answer to an inquiry as to the present status of the proposed extension from Whetsell, W. Va., to Albrightsville, an officer writes that no work has yet been done but that preliminary surveys are now under way. The Cheat Valley at present extends from Rowlesburg to Whetsell, a distance of seven miles, and is operated for freight only. (Construction Supplement, March 14, 1902.)

CHICAGO & NORTH WESTERN.—It is announced under date of April 29, that trains are now running on the Rice Lake & Birchwood branch from Spooner to Birchwood, Wis., a distance of 41 miles. It is also announced that the Spring Valley line extension from Spring Valley to Weston, nine miles, was opened May 1.

CHICAGO GREAT WESTERN.—Bids have been asked for the proposed 30-mile cut-off from Oelwein, Iowa, to Waverly, which will reduce the line between Chicago and Omaha by 10 miles. It is planned to begin work by the middle of May, and it is thought that it will be completed in a year.

The work of grading the extension from Fort Dodge to Council Bluffs, Iowa, is now under way, and grading camps are established along the entire route. Winston Bros., of Minneapolis, have the contract for grading the entire line, and have sublet all but one mile of the work. The sub-contractors are: Hall Construction Company, of St. Louis; Phelan & Shirley, of Omaha; Conk & Eull, of Minneapolis; E. A. Wickham, of Council Bluffs; Ryan Bros., of Missouri Valley, Iowa; Conray & Vaughn, of St. Louis; Webb & Neil, of Kansas City, and Bates & Rogers, of Chicago. The Hall Construction Company has the first four miles out of Council Bluffs and also some work inside the city limits. Phelan & Shirley have the next five miles and also one mile near Harlan. They are now at work on this mile, which includes a 44-ft. cut and a 39-ft. fill. Conk & Eull have the contract for 31 miles, from the Botna River, near Harlan, to the other side of Manning. The work is all light. There is one stretch of work 10 ft. deep and 4,000 ft. in length, and another 15 ft. deep and 400 ft. long, with an 11-ft. fill in between. E. A. Wickham has the contract for several miles near Minden, and also a small section at

another point along the line. He has already commenced work. Winston Bros. have commenced work on the mile which they retained near Silver. Ryan Bros. have one mile. This includes one 18-ft. cut. Webb & Neil also have about a mile, which they expect to complete in the near future. Conray & Vaughn have a two-mile stretch west of Silver, and also another two miles near Carroll. The two miles near Silver includes a 40-ft. cut and a 40-ft. fill. Bates & Rogers have the contract for the erection of bridges and stone culverts. They have commenced work on a concrete bridge 172 ft. in width, with a 12-ft. arch.

COLUMBIA & NEHALEM.—Work is reported in progress on this proposed line in Oregon, which is run from Columbia west to the head waters of the Nehalem River, a distance of about 12 miles. It is expected that the first four miles will be in operation as a lumber line within 60 days. Later on it is intended to use the road for general freight and passenger traffic as well.

DENVER & RIO GRANDE.—Work was reported begun April 28 on the new branch up the north fork of the Gunnison River, Colo., from Delta to Paonia, a distance of about 45 miles. (April 25, p. 315.)

EDGEWATER & FORT LEE.—At a meeting of the New Jersey Riparian Board May 1, application was received from the above company for license to cross the lands of the State where the right of way lies outside of high water. It is said that the company has been formed to build an extension for the New York, Susquehanna & Western along the Hudson River from Edgewater, N. J., to Fort Lee, a distance of about four miles. Rights of way along the shore lands to be used have been largely given by the owners, but it is necessary to get permission from the Riparian Board before trestle work or other structures involving the use of the lands under water can be begun.

HAVANA & JAINANITAS (ELECTRIC).—This company, which has headquarters at Youngstown, Ohio, has been incorporated under the laws of Delaware to build an electric road between Havana and Jainanitas, Cuba, nine miles. W. H. Park, H. G. Hamilton and others of Youngstown, Ohio, are interested. J. D. Milligan will be in charge of the work in Cuba.

ILLINOIS CENTRAL.—Bids are asked for grading and other work on the projected extension from Paducah, Ky., to Cairo, Ill., 32 miles. Surveys were recently reported on the final location of this line. (April 4, p. 258).

INTERNATIONAL & GREAT NORTHERN.—Amendment to this company's charter to provide for its extensions was filed at Austin, Texas, April 30, and provides for more than 300 miles of new line. The extensions as named in the charter are as follows: From or near Navasota to Waxahachie, where connection will be made with the Fort Worth Division, a distance of about 195 miles. This line will pass through a rich agricultural section of the State, among the important towns on the proposed route being Anderson, Madisonville, Oakwoods, Centerville and Corsicana. The other extensions named are from Neches, Anderson County, to Coltharp, Houston County, about 85 miles, through a pine timber country; from Palestine to Rusk, 30 miles; from a point on the Fort Worth Division, 11 miles north of Italy to Dallas, about 30 miles, and from East Columbia to Bay City, 25 miles.

KANSAS CITY, MEXICO & ORIENT.—The concession granted by the Mexican Government for a railroad between Durango, Mexico, and Gutierrez, on the Mexican Central, which was declared forfeited on April 1, has been renewed to the same parties. There was opposition to the renewal by Governor Juan Santa Marina, of the State of Durango, and other influential citizens of that State, but as Mr. Stilwell's representative complied with all the requirements necessary to secure the renewal it was granted to them. It is reported that the proposed road will form a link in a line which the Kansas City, Mexico & Orient propose to build to the City of Mexico. (May 2, p. 336.)

KLONDIKE MINES.—Contract has been let to J. J. Campbell to furnish 50,000 ties for this line. Application was made last March for permission to build from Dawson, in the Province of Yukon, to the Stewart River, making a railroad connection to all larger placer mining districts of the Klondike. It is said that work will begin this summer. (March 21, p. 217.)

LA CROSSE & BLACK RIVER FALLS (ELECTRIC).—This company filed articles of incorporation in Wisconsin April 25. The incorporators propose to build from La Crosse to Black River Falls, 50 miles northeast. (See La Crosse & Eastern below).

LA CROSSE & EASTERN (ELECTRIC).—This company was recently incorporated in Wisconsin to build an electric line from La Crosse to Virginia, Wis., 35 miles southeast. (See La Crosse & Black River Falls.)

LAKE SHORE & MICHIGAN SOUTHERN.—Contract has been let to John M. Hackett, of Dunkirk, N. Y., to build three miles of the cut-off between Ashtabula and Youngstown, Ohio, on the branch which was surveyed last winter. This line will avoid several heavy grades and will shorten the present distance between Youngstown and Ashtabula, via Coalburg, Andover, Jefferson and Plymouth, 10 miles. The present route is 63 miles long.

LAUREL & ELLISVILLE.—A proclamation has been issued by Governor Longino incorporating this company, with rights to build a line between the points named in Mississippi through timber lands. The distance is about 25 miles, and there have been similar projects before in that locality.

MAZATLAN & TOPO.—Work is reported begun on this new narrow gage line which is to be built between the port of Mazatlan, Mexico, and Topo, in the State of Durango, a distance of about 140 miles. The owners and builders are Sibley, Miller & Co., of San Francisco, who own gold and silver mines at Topo.

METROPOLITAN (LONDON).—Contracts for the electric generating station of the London Metropolitan Ry. have been let to the British Westinghouse Electric & Mfg. Co. of Manchester.

MEXICAN CENTRAL.—Several surveying parties are reported in the field locating extensions and branch lines in northern Mexico. One of these lines, which has just been located, runs from Jaral to Saltillo, and another runs from San Pedro northeast to Jaral. Surveys are also being made for a line from some point on the Monterey & Mexican Gulf, to Laredo, Texas.

MILWAUKEE, BENTON HARBOR & COLUMBUS.—At a meeting of the stockholders April 27 it was voted to extend the line from its present terminus at Buchanan, 10 miles south to South Bend, Ind. It is at present in operation between Benton Harbor and Buchanan, 27 miles.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—It is said that work is to be begun at once on an extension from Braddock, N. Dak., to Bismarck, 40 miles distant. This stretch is to be laid with relay rails taken from the Eastern Division of the road. It is thought that trains will be running into Bismarck during July.

NEW YORK CENTRAL & HUDSON RIVER.—The New York Railroad Commission gave a hearing May 2 on a proposition to widen the right of way above the Schenectady turnpike just west of West Albany, N. Y., so as to admit of nine more tracks. The proposed change will also allow the Schenectady Electric line one more track through the subway.

NEW YORK, SUSQUEHANNA & WESTERN.—See Edgewater & Fort Lee.

NORTHERN OKLAHOMA.—Charter has been given this company in Oklahoma for a term of 20 years to build through the Counties of Grant, Garfield, Kingfisher, Logan, Canadian and Oklahoma in Oklahoma, and Harper, Kingman, Barber and Pratt in Kansas, a total distance of 250 miles. The company's office is at Enid, Okla. T., and the incorporators are H. I. Wassen, of Pond Creek; J. A. Hill, of Enid, and others.

NORTH RIVER (ELECTRIC).—The New York State Railroad Commission gave a hearing May 1 on this company's application to build a line from Saratoga Springs to South Glens Falls, N. Y., 18 miles. Opposition is being made by the Hudson Valley.

OHIO RIVER & CHARLESTON.—Surveys for this line, now in operation between Johnson City and Huntdale, Tenn., 34 miles, have been extended across the Blue Ridge in North Carolina toward Morgantown. The engineer is quoted as saying that the grade for the 17 miles of mountain line will not exceed 1½ per cent.

OTTAWA, NORTHERN & WESTERN.—This line in Quebec will pass into the hands of the Canadian Pacific within a few days, and in connection with the new ownership, contract has been let to H. J. Beemer for an extension from the present terminus at Gracefield, Que., to Maniwaki, 23 miles north. It is said that work on this will begin at once. G. C. Dunne is Chief Engineer. (See under Ottawa & Gatineau, Construction Supplement, March 14, 1902.)

PITTSBURGH, SHAWMUT & NORTHERN.—An officer writes that the following work is to be done this year: Extension from Clermont, Pa., to Kasson, 7.4 miles; from Coreyville, Pa., to Olean Junction, N. Y., 14 miles, and from Bolivar, N. Y., to Angelica, N. Y., 23 miles. Locations on all of these extensions are practically completed and it is expected that part of the work will be let within a few days. The work is to be first-class in every particular, with cuts 20 ft. wide, embankments 16 ft. wide, bridges of stone and steel, 85-lb. A. S. C. E. rail, steel bridges to be proportioned for consolidation engines with 180,000 lbs. on the drivers. The maximum grade against traffic will be 28 ft. per mile, compensated, for single engines, with one equivalent pusher grade. The return grades will be so adjusted as to admit of 25 per cent. of the number of cars that can be taken north per train coming back loaded, and 75 per cent. empty. The Pittsburgh, Shawmut & Northern is essentially a coal road, and the heavy tonnage will almost all be northbound. In addition to the extensions mentioned above, a large amount of work has also been laid out for the improvement of existing lines and for future extensions.

RAILROAD BRIDGE & TERMINALS.—Articles of incorporation of this company were filed in Iowa April 30, with principal place of business at Sioux City. The purpose of the company is to buy or build lines of railroad within Sioux City, with all necessary terminals, and to build tracks connecting the railroad bridge over the Missouri River, belonging to the Combination Bridge Co., with the terminal property belonging to the Union Terminal Co. The incorporators and directors are D. L. Plumer, F. W. Estabrook, T. King and others.

SALT LAKE & OGDEN (ELECTRIC).—Right of way is now being purchased for this proposed line from Salt Lake to Ogden, Utah, a distance of about 20 miles, and final surveys are being made. Some material has already been ordered and it is expected that the road will be built this summer. S. Bamberger is President.

SANTA FE CENTRAL.—Grading on this proposed line between Santa Fe, N. Mex., and Chameleon, 120 miles, was reported to have begun May 1. The line between Kennedy and Santa Fe is to be graded first and it is intended to have it ready for track laying when the rails which are ordered have arrived next August. The work on this portion of the line will be more difficult than the remainder.

SCHENECTADY (ELECTRIC).—At a meeting of the stockholders April 30, favorable action was taken upon a proposition to extend their line in Saratoga, Rensselaer, Montgomery, Fulton, Warren, Washington and Columbia Counties, N. Y. The line is now in operation between Albany and Schenectady, and also in the city of Schenectady, and a proposed extension to Ballston was filed April 21. (April 25, p. 316.)

TRI-STATE TERMINAL.—This company was incorporated May 2 to build a railroad from Huntington, W. Va., along the Ohio River to Ashland, Ky., and thence crossing to Ironton, Ohio. The total distance which it is proposed to build is about 23 miles, and the Iron Ry. would be paralleled a portion of the distance. The incorporators are W. C. Merrett, T. J. Bryan, E. M. Watts and others of Huntington.

VANPORT & GLASGOW ELECTRIC.—Incorporation was granted April 29 to a company which proposes to build an electric road 11 miles long from a point in the village of Vanport, Beaver County, Pa., to a point on the Ohio State line. Harry C. Eagle, of Merchantville, N. J., is President.

VELLAJO, BENECIA & NAPA VALLEY.—This company was incorporated in Los Angeles April 26, to build a railroad 100 miles long from Benecia in Solano County, through Napa to Lakeport in Lake County, with two branches. The capital stock is $100,000, paid up, and the incorporators are W. F. Botsford, John Cross and others, of Los Angeles.

VIRGINIA & ATLANTIC.—This company was incorporated at Charleston, W. Va., April 25, and proposes to build from a point on Dry Fork and Tug River, McDowell County, W. Va., down that river to a connection with the Norfolk & Western. The incorporators are R. E. Hainer, V. L. Black and others, of Charleston.

WABASH.—Contracts for portions of the proposed line from Zanesville, Ohio, to the Ohio River are to be let within the next two months. The surveys of this portion of the route are almost completed. The present line of the Little Kanawha is to be extended from the terminus at Palestine, W. Va., to Belington, on the West Virginia Central & Pittsburgh. The work includes a cantilever bridge across the Ohio River at Parkersburg. The whole project will involve about 200 miles of new railroad.

WEST PITTSBURGH CONNECTING.—This company was incorporated April 29, to build a steam railroad nine miles long from Chewton to New Castle, Lawrence County, Pa. Henry O. Evans, of Pittsburgh, is President.

GENERAL RAILROAD NEWS.

CHICAGO, BURLINGTON & QUINCY.—Sealed proposals to sell to the company C., B. & Q. Nebraska extension 4 per cent. bonds, due May 1, 1927, at a price not to exceed 110 per cent. and accrued interest, will be received by the New England Trust Co., trustee, Boston, until May 15. The sum of $294,410 has been set apart by the railroad for this purpose.

CHICAGO, GREENVILLE & SOUTHERN.—This road, which is four miles long and extends from Durley, on the Jacksonville & St. Louis, to Greenville, was sold April 29 to Major Bluford Wilson, of Springfield, for $10,000. The road has been heavily mortgaged and has been operated for some years by the Jacksonville & St. Louis.

CHICAGO, ROCK ISLAND & PACIFIC.—Announcement is made that this company has purchased the St. Louis, Kansas City & Colorado from St. Louis, Mo., to Belle, 105 miles. This line was originally chartered in 1884, and it was for some time operated by the Atchison, Topeka & Santa Fe. The stock of the Wiggins Ferry Co. has also been purchased by the Rock Island. This, when necessary connections are built, will give the company an entrance and terminals in St. Louis.

CINCINNATI, DAYTON & TOLEDO TRACTION.—The stockholders of the Southern Ohio Traction and of the Cincinnati & Northwestern will meet May 7 at Hamilton, Ohio, to organize the above company as a consolidation of their interests. The consolidated company will operate electric lines from Cincinnati to Toledo, Ohio, and will have a capital of $5,000,000.

CINCINNATI, NEW ORLEANS & TEXAS PACIFIC.—President Spencer on April 25 met the trustees of the Cincinnati Southern for a conference regarding a proposed issue of bonds at the rate of $500,000 a year for five years, the total amount authorized being $2,500,000. These are chiefly to provide for terminals, and the purpose of the conference is to determine the rate of interest the bonds shall bear, and other details. (See under Railroad Construction, March 14, 1902).

DETROIT UNITED.—E. H. Gay & Co. offer at 97½ and interest $1,000,000 Detroit United first consolidated mortgage 4½ per cent. gold bonds, dated Jan. 1, 1902, and due in 1932, subject to call at 105 and interest. They state that the Detroit United was incorporated in 1900, and owns or controls 504 miles of road comprising all the street railroad lines in the city of Detroit and suburbs. The total amount of outstanding bonds is $16,880,000. The capital stock is $12,500,000.

FAIR HAVEN & WESTVILLE (ELECTRIC).—An increase of capital stock from $3,000,000 to $5,000,000 has been authorized by the stockholders.

GEORGIA SOUTHERN & FLORIDA.—An equipment agreement was filed April 30 between this company and Blair & Co., of New York, involving $460,010, and providing for 500 box cars, 100 flat cars, 40 coal cars and 25 stock cars.

GREAT NORTHERN OF CANADA CONSOLIDATED.—This company was incorporated in New Jersey April 28, with an authorized capital stock of $10,000,000, presumably to own the securities of one or more of the properties which are controlled by W. Seward Webb and his associates.

ILLINOIS CENTRAL.—Kuhn, Loeb & Co., announced April 30 that they would receive subscriptions at 94½, plus accrued interest since Jan. 1, 1902, for $80,000,000 4 per cent. Illinois Central stock interest certificates, series A, of the Railroad Securities Co. These certificates are secured by deposit of stock to the United States Trust Co.

MAHONING VALLEY (ELECTRIC).—The capital stock was increased on April 29 from $1,500,000 to $2,500,000. The company at present operates 36 miles of electric lines in the vicinity of Youngstown, Ohio.

MEXICAN CENTRAL.—The line of railroad partly built between Sandoval, on the Vera Cruz line to Tampico, together with other concessions, has been bought by the Mexican Central from Richard Honey for $900,000 gold. It is said that the Mexican Central will build a connecting line between its existing line and its new purchase, and that surveys have already been made.

MEXICAN NATIONAL.—Speyer & Co., Kuhn, Loeb & Co., and Speyer Bros., of London, give notice that on and after May 1, holders of certificates of deposit issued under the plan of readjustment dated Oct. 8, 1901, may receive new securities and cash to which they are entitled, upon presentation and surrender of their certificates to the Central Trust Co., 54 Wall street, New York, or at offices designated in London and Amsterdam. The plan of readjustment is given fully in our issue of Oct. 18, 1901, p. 730.

ST. LOUIS & GULF.—This company was incorporated April 18, with a capital stock of $5,000,000, to take over the following lines in Missouri, controlled by the Houck interests. It is proposed to unite the properties into a continuous line by building connecting links. The existing lines are:

St. Louis, Kennett & Southern, and Pemiscot Southern	44 miles.
Kennett & Osceola	14 miles.
St. Francis Valley	10 miles.
Cape Girardeau, Bloomfield & Southern	26 miles.
Morley & Morehouse	16 miles.
Houck's Missouri & Arkansas	26 miles.
Clarkton Branch	5 miles.

WESTERN MARYLAND.—Sale of this property to the Fuller-Gould Syndicate has finally taken place for $8,751,000 after a protracted contest. The chief reason why the city of Baltimore gave this bid preference over those of other parties, who offered higher sums, is that the Fuller Syndicate has a controlling interest in the West Virginia Central & Pittsburgh and proposes to form an outlet for the Wabash with a terminus at Baltimore. The negotiations have occupied a long time, the first offer which led to the present outcome having been made to Mayor Hayes last September. There has been considerable opposition in the interest of other bidders, and the final development of the property is a matter concerning which there is much doubt. (April 11, p. 278.)